2011-01-01

An Overview of New Psychoactive Substances and the Outlets Supplying them

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Recommended Citation

Kelleher, C., Christie, R., Lalor, K., Fox, J., Bowden, M., O'Donnell, C.: An Overview of New Psychoactive Substances and the Outlets Supplying Them. National Advisory Committee on Drugs. 2011. http://www.nacd.ie/publications/Head_Report2011_overview.pdf

NACD
National Advisory Committee on Drugs

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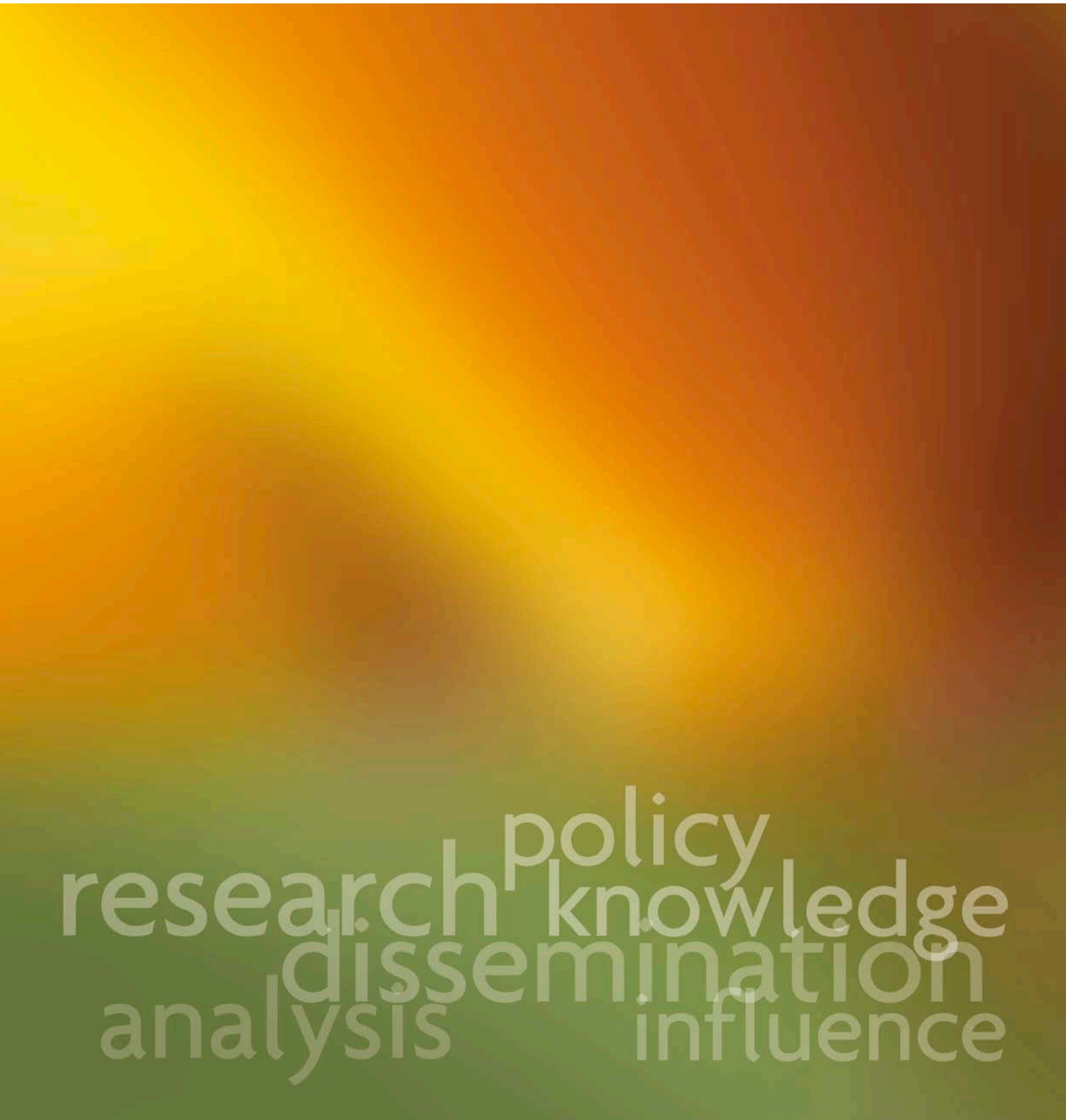

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An Overview of New Psychoactive Substances and the Outlets Supplying Them

Commissioned by the National Advisory Committee on Drugs (NACD)

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1 Supplementary information supplied with this report consists of 1) report forms detailing each product that was subjected to chemical analysis; 2) mass spectra for the products analysed; and 3) the survey instrument.

Foreword

I welcome the National Advisory Committee on Drugs Report An Overview of New Psychoactive Substances and the Outlets Supplying Them as an important contribution to our overall efforts to curb the use of such substances.

The issue of new psychoactive substances, and the outlets selling them, are of serious concern to societies and to Governments in Ireland and across Europe. Reports such as this highlight the dangers involved and set out a comprehensive list of recommendations for addressing the various aspects of the problems involved.

A number of initiatives have already been taken in Ireland to tackle the new psychoactive substances problem and these have achieved significant success. However, drugs supply and drugs consumption tend to shift in response to legislative changes and the report stresses the on-going need for monitoring and action to tackle any new risks that emerge with appropriate and timely responses.

I would like to express my appreciation to all those involved in compiling this Report. Among them were the research participants who shared their experiences and who contributed valuable insights, the agencies that facilitated their participation, the researchers from the School of Chemical and Pharmaceutical Sciences at Dublin Institute of Technology; the members of the Research Advisory Group; and Dr Des Corrigan, Chair of the NACD, as well as all the staff of the Committee.

Róisín Shortall, T.D.
Minister for State with Responsibility for Primary Care, Department of Health

Preface

The NACD has been concerned about the Headshops issue for a number of years. In conjunction with the then National Drug Strategy Team (NDST) it conducted the first of many briefings for Drug Task Forces on the challenges posed by these outlets and the New Psychoactive Substances (NPAS) they offered for sale through retail and online outlets in December 2007. Intensive discussions with the then Minister for Drugs John Curran during 2009 resulted in a ministerial request to the NACD to prepare a report into all aspects of the phenomenon which would inform a legislative solution to the problem caused by NPAS.

The NACD convened a multidisciplinary Research Advisory Group (RAG) comprised of representatives of An Garda Siochána, Customs Drug Law Enforcement, Dept. of Health and Children, Office of the Minister for Drugs (Dept. of Community, Equality and Gaeltacht Affairs), the Irish Medicines Board, the Food Safety Authority of Ireland, The Health and Safety Authority, the Health Service Executive, the Forensic Science Laboratory, Citywide Drug Crisis Campaign and the NACD itself. The RAG recommended that the NACD commission an in-depth study of the Headshop phenomenon including laboratory analysis of the products being offered from both online and retail outlets.

The Request for Tender was issued in February 2010 and the contract for this work was awarded to a team from the Centre for Social and Educational Research (CSER) at the Dublin Institute of Technology (DIT). The NACD is grateful to Cathy Kelleher, Rachel Christie, Kevin Lalor, John Fox, Matt Bowden and Cora O'Donnell of the CSER for their efforts, not least in working to a very tight deadline. The NACD also wishes to acknowledge the generosity of Dr Pierce Kavanagh and his colleagues in the Dept. of Pharmacology and Therapeutics, Trinity College Dublin who shared their analytical results with the DIT team and with the NACD.

The review focuses on potential new substances that may come to be sold in head shops and online particularly substances which are not yet controlled under the Misuse of Drugs legislation, and so inform a legislative response to deal with such substances. The project includes the chemical analysis of existing and novel psychoactive substances, a review of emerging scientific literature, an online survey of users and a number of interviews with both 'recreational' and 'problem users'. Risk factors and harm reduction measures and approaches to restricting psychoactive substances in other jurisdictions are also considered. Having considered the Report, the RAG and the NACD formulated a number of recommendations which were presented to the Minister and the Oversight Forum on Drugs (OFD).

- The NACD recognises the hugely positive effects of the Government decision in May 2010 to schedule a large number of synthetic cannabinoids and some cathinones ("bath salts") as Controlled Drugs under the Misuse of Drugs Acts and also the subsequent enactment of the Criminal Justice (Psychoactive Substances) Act 2010. The NACD recommends that the work of the Department of Health in conjunction with the Department of Justice and Law Reform, the Gardaí, the Customs Service, the Forensic Science Laboratory, the Irish Medicines Board and others to closely monitor the emergence of new psychoactive substances with a view to bringing them under the Misuse of Drugs Act should continue to be supported in order to deter efforts to circumvent legislative controls (e.g. the Criminal Justice(Psychoactive Substances) Act 2010) on the import of these materials.

- Ireland should collaborate more closely with initiatives in the UK and other EU Member States to restrict access to new psychoactive substances and to ensure that legislative controls are not bypassed.
- A challenge may exist in terms of the monitoring of online outlets for the sale and supply of new psychoactive substances. In terms of further addressing the issue, efforts could be made to examine existing models of online monitoring which may curtail such trade including, for example, the model of co-operation in place between the Irish Medicines Board and the Customs authorities to monitor the sale of counterfeit medicines.
- The Report includes evidence that many products containing new psychoactive substances are placed on the market as food. These foods also contain drugs such as caffeine, synephrine, 2-PEA and DMAA or else substances which are naturally found in foodstuffs. Consumer protection in respect of such foods should be a matter for the Food Safety Authority of Ireland in the context of food legislation.
- Preliminary contacts indicate that there is no readily accessible national database on the health-related issues experienced by individuals who have consumed new psychoactive substances presenting to Emergency Departments of Acute Hospitals. The development of a centralised national database to collect data from Emergency Departments on alcohol and other drug use, as well as presenting issues and demographic data, which could be developed and managed by an appropriate agency, such as the Health Research Board or the Economic and Social Research Institute (which details hospital admissions each year) is recommended. This would make it possible to verify the harm being caused by existing and newly emerging drugs. Standardisation of information collected by Emergency Departments will be key to implementing this recommendation. This has implications in relation to further data collection in relation to alcohol and other drugs in Emergency Departments.
- The National Drugs Awareness Campaign recently launched by the HSE to raise awareness of the dangers and significant mental and physical health effects that can be caused by psychoactive substances should take account of user experiences of new psychoactive substances as recorded in the project Report.
- Online awareness campaigns, along the lines developed by Drugs.ie which use advertisements on Facebook and Twitter, as well as active engagement with online discussion sites and other online media outlets frequented by young people, play an important role in highlighting the risks of psychoactive substances. In addition to the potential health risks posed by psychoactive substances, users run the risk of unintentionally engaging in criminal behaviour through the purchase of so called 'legal' psychoactive substances that in fact contain controlled substances. The National Drugs Awareness Campaign could communicate this issue to users who may otherwise not be aware of the facts and the risks involved.
- Section 5 of the Report highlights the importance of accurate and context-specific harm reduction messages in the early days of emergent drug use, when both scientific and lay knowledge is limited. Given the level of polydrug use reported by survey respondents, it is recommended that harm reduction interventions are designed to target this pattern of substance abuse. Targeted harm reduction messages and guidelines for stimulant use aimed at problematic drug users along the lines developed by the Ana Liffey Drugs Project are also recommended and should inform public health promotion campaigns. This could be facilitated through better signposting of harm reduction advice on the Drugs.ie website.
- It is recommended that the impact of recent legislative changes is assessed, so that any new risks that may emerge can be identified and appropriate responses made. In this context, it is recommended that research on emerging trends in drug use should be seen as a priority for the social and biomedical science research communities and their funding bodies.

- A standardised system of recording and reporting intoxications would enhance the potential to understand and respond to risks associated with new psychoactive substances. In order to facilitate this, there is a need to have rapid access to a suitably equipped laboratory that can take on the task of rigorous testing of new and emerging psychoactive substances, a laboratory that has the time and manpower to test identity, purity and concentration. Such a laboratory would provide timely information in relation to the detection of new psychoactive substances which would facilitate the early dissemination of harm reduction messages.
- For the purposes of identification of new psychoactive substances by forensic and pathology laboratories, and the development of drug field tests, there is an urgent need to establish a body providing a catalogue of reference standards speedily and at affordable prices. Such a body could provide a dedicated service not just to Ireland but to other EU countries, thus providing a continent-wide service/ resource to address the issue of newly emerging psychoactive substances. In the context of the forthcoming review of the Council Decision on information, exchange, risk assessment and control of new psychoactive substances, this needs to be raised by Ireland at EU fora such as the Horizontal Drugs Group.
- The British government announced on August 20, 2010, that it will introduce legislation in the first session of parliament to temporarily ban psychoactive substances that are currently legal, but used by people to become intoxicated. The temporary ban will mean that it will be unlawful to possess with intent to supply, offer to supply, import, export, or produce the drugs in question under the UK Misuse of Drugs Act 1971. The introduction of legislation in Ireland that would allow temporary control of psychoactive substances pending assessment of the risks of the constituents is also recommended. This would prevent adverse health events.

I want to take this opportunity to thank the members of the RAG :- Ms Marita Kinsella, Dr. Jean Long, Dr. Brian Redahan, Mr. Raymond Ellard, Dr JM Morris, Dr. Audrey O'Donnell, Dr Carol Downey, Ms Dairearca Ní Néill, Ms Maria Ryan, Ms Gillian Treacy, Ms Majella Cosgrave, Ms Sinead O'Mahony Carey, Mr. John Garry, Mr Niall Cullen, Mr. Daithi Doolan, Detective Sgt. Brian Roberts, Mr. Tony Duffin, for their commitment and for so readily sharing their individual and corporate expertise.

As ever my colleagues and I are indebted to Ms Susan Scally the then interim Director of the NACD and her colleagues, Alan Gaffney and Mary Jane Trimble for their efforts in preparing this Report for publication.

While many Headshops have closed and a large number of products are no longer on open sale it is well known that some are still available either on the black market or over the internet. These chemicals pose ongoing challenges but thanks to this Report we have a clearer picture of exactly what those challenges are.

Dr Des Corrigan FPSI
Chairperson NACD

Acknowledgements

This research was commissioned by the National Advisory Committee on Drugs (NACD) and undertaken by the Centre for Social and Educational Research, Dublin Institute of Technology. The NACD convened a Research Advisory Group to mentor and monitor this process and the research team would like to extend its appreciation to the NACD and to the members of the Research Advisory Group for their assistance and support throughout.

Special thanks also go to the Merchants Quay Project, the Ana Liffey Drug Project, the Garda National Drugs Unit, and the Forensic Science Laboratory for their contribution to the research.

The researchers are particularly grateful to the many research participants who took time to share their experiences, and for the valuable insights they contributed. They would also like to thank the agencies that helped to promote the research.

Finally, they would like to acknowledge the support of the School of Chemical and Pharmaceutical Sciences at Dublin Institute of Technology.

Executive summary

This report represents the outcome of a review of new psychoactive substances[2] within the Irish context, including a review of the outlets that supply these substances. The review was commissioned by the National Advisory Committee on Drugs (NACD) in accordance with Action 14 of the National Drugs Strategy (interim) 2009–2016. Action 14 provides for the monitoring of 'head shops'[3] and other outlets for the sale of psychoactive substances, under the Misuse of Drugs Act 1977 and the Misuse of Drugs (Amendment) Regulations 2007. Researchers at the Centre for Social and Educational Research (CSER) within the School of Social Sciences and Law at Dublin Institute of Technology (DIT), and at the School of Chemical and Pharmaceutical Sciences (DIT), conducted the review between May and August 2010.

The proliferation of head shops and online retailers has facilitated the emergence of a range of new psychoactive substances in Ireland. Such outlets have supplied products containing powerful synthetic substances that mimic the common illegal stimulants cocaine, ecstasy and amphetamine; they have also supplied synthetic cannabinoids designed to serve as cannabis substitutes. Often these substances are 'research chemicals', with no medicinal value, and where there is little existing knowledge in relation to their safety or toxicity. The location of head shops in prominent areas has highlighted their existence, and has fuelled concerns relating to their unknown potential for causing harm. The 'head shop phenomenon' has received unprecedented attention from the general public and the media, while the dynamic nature of the phenomenon has led to demands for a swift and comprehensive response from legislators.

In response to the 'phenomenon', the Government introduced legal measures, including the control of BZP (March 2009) and the control of mephedrone (May 2010). Also in May 2010, the Government made an Order under the Misuse of Drugs Acts 1977 and 1984 controlling a broad range of new psychoactive substances, including benzylpiperazine derivatives, synthetic cannabinoids and a number of named cathinones. In August 2010, the Criminal Justice (Psychoactive Substances) Act 2010 came into operation, making it an offence to sell, import, export or advertise psychoactive substances. This move coincided with a sharp decrease in the number of head shops which had been open for business and a significant decrease in the availability of new psychoactive substances in the few shops remaining open.

This review represents the aggregation of available knowledge on new psychoactive substances within the Irish context, and empirical research aimed at providing new insights into this complex phenomenon. Specifically, the review sought to assess the availability and accessibility of new psychoactive substances in retail outlets throughout Ireland and online, and to identify and describe the products, and where possible, their specific contents. A range of new psychoactive substances was acquired and was subjected to Gas Chromatography Mass Spectrometry (GC-MS) chemical analysis in order to identify active constituents. The availability of reference standards for the analysis of new psychoactive substances was also determined.

2 According to Article 3 of Council Decision 2005/387/JHA of 10 May 2005 on the information exchange, risk assessment and control of new psychoactive substances, 'new psychoactive substance' means a new narcotic drug or a new psychotropic drug in pure form or in a preparation; 'new narcotic drug' means a substance in pure form or in a preparation that has not been scheduled under the 1961 United Nations Single Convention on Narcotic Drugs, and that may pose a threat to public health comparable to the substances listed in Schedule I, II or IV; 'new psychotropic drug' means a substance in pure form or in a preparation that has not been scheduled under the 1971 United Nations Convention on Psychotropic Substances, and that may pose a threat to public health comparable to the substances listed in Schedule I, II, III or IV.

3 'Head shops' are retail outlets specialising in the sale of new psychoactive substances and/or drug paraphernalia (e.g. pipes and bongs).

Alongside the analyses, published data in relation to new psychoactive substances and their effects were reviewed and an online survey of users of head shop products or 'legal highs' (as they are commonly known) was conducted in order to gain insights into patterns of use and reported effects. To further explore the use and effects of these substances, semi-structured interviews were conducted with both 'recreational' users and 'problem' drug users. Based on available information and data gathered, a number of risks associated with the use of new psychoactive substances were identified. Harm-reduction measures to minimise risk to users were considered in light of existing advice for users of cannabis and stimulant drugs. Finally, measures taken in other jurisdictions to restrict psychoactive substances were examined.[4]

Summary of key findings

Key findings of the review are summarised below:

Chemical analyses

A total of 42 post-Ban products and seven pre-Ban products were sourced from Irish head shops and online outlets. These products were analysed using either Gas Chromatography Mass Spectrometry (GC-MS) or the TICTAC database, where applicable. All products were in powder and tablet form, with the exception of just one – a herbal smoking product.

The analyses revealed the following:

- Caffeine was present in 26 of the 42 products (61%).
- The following new psychoactive substances, which did not come under the Government Orders, were detected during the analysis: dimethylcathinone, naphyrone, fluorotropacocaine, desoxypipradrol and dimethylamylamine. Naphyrone was the most frequently observed of the new psychoactive substances, being identified in 12% of samples.
- Of all types of new psychoactive substances, the packaging of those in powder form listed the least amount of information: 79% of powder products listed no ingredients. In contrast, 75% of tablet products and 67% of capsule products listed ingredients. None of the herbal products listed ingredients.
- The most frequently listed ingredients on packaging were *Citrus aurantium*, anhydrous caffeine, *Pelargonium graveolens* and *Theobroma coca*.
- Controlled substances were found in two of the 37 products sourced in Irish head shops. The controlled substance detected in these two products was 3,4-Methylenedioxypyrovalerone (MDPV).
- When tested, all of the products purchased prior to the Government Order (May 2010) contained substances that came under control with the Order. Mephedrone was the most frequent psychoactive substance encountered in the analysis of these products (67%).
- Five products purchased online underwent analysis and all five contained controlled substances. The controlled substances detected were MDPV, mephedrone and 1-(3-Trifluoromethylphenyl) piperazine (TFMPP).

4 It was envisaged that data regarding new psychoactive substance-related presentations at hospital emergency departments would be included in this report; however access to emergency department data was not possible during the time frame of the review. Access requires the approval of each individual hospital's research ethics committee. Findings emerging from hospital emergency department data will be presented as a scientific paper following publication of this report.

Availability of new psychoactive substances

- The number of head shops in Ireland has been decreasing significantly on foot of actions taken by the Government to restrict and control new psychoactive substances.
- The number of online retailers is vast. Many of these retailers appear to deliver to Ireland.
- At the time of the review, fewer people appeared to be purchasing new psychoactive substances via the Internet relative to their UK counterparts.

The use and effects of new psychoactive substances

Very little data has been published on the recreational use of, or the effects of, new psychoactive substances. Some pharmacological data has been published on substances which have been used for research purposes or for medicinal purposes. In the absence of scientific evidence, it is advisable to consider each new substance as unique in its action and in its effects, and to exercise caution with respect to inferring effects of substances based on structure-activity relationships. Subjective user reports are plentiful, but must be interpreted with caution. The current investigation revealed the following key findings:

- Problem drug users appear to be an especially vulnerable subgroup of new psychoactive substance users. Frequently, substances were being used in large quantities, and were also being used intravenously. The pattern of use is associated with increased health and social risks to the individual, and is also associated with public health risks. In particular, the use of new psychoactive substances among problem drug users has been associated with skin and vein damage, increased occurrence of abscesses and ulcers, and the rapid onset of psychosis.
- The use of new psychoactive substances among problem drug users appeared to have led to a change in the pattern of heroin use, which did not involve a reduction. Instead, heroin and new psychoactive substances were being used either simultaneously or successively to stave off or cope with the negative 'come-down' effects experienced with each substance.
- 'Amplifier' or 'Amplified', a product which has been shown to contain dimethocaine (Kavanagh *et al.*, 2010c), may be especially potent when used intravenously in high doses.
- Problem drug users' reports of compulsive re-dosing and tolerance effects may be indicative of the abuse potential of new psychoactive substances in powder form.
- Survey findings indicated a pattern of recent infrequent use of new psychoactive substances among a subgroup who may be described as 'recreational' users of new psychoactive substances. It is likely that this pattern of usage reflects the impact of the May 2010 Government ban on a range of substances. The use of substances available before the May 2010 Order was reported more often than the use of substances available after the May 2010 Order.
- A wide range of new psychoactive substances had been sampled by survey respondents. The use of mephedrone and BZP was most widely reported. The use of ethnobotanical substances was less common; however *Salvia divinorum* was sampled by almost a quarter of all survey respondents.
- Users of new psychoactive substances tended to have a history of illegal drug use (notably cannabis, ecstasy, and cocaine) and use of new psychoactive substances was related in particular to two factors: 'curiosity' and 'availability'. Following the introduction of controls on a range of new psychoactive substances (May 2010), and in anticipation of further restrictions on such substances being introduced , it appears that users may be switching back to illegal drugs such as cannabis, ecstasy and cocaine. The authors of this report recommend that the impact of legislative changes on the pattern and use of new psychoactive substances be monitored closely.

- 'Recreational' users of new psychoactive substances are likely to mix them with other substances, especially cannabis, ecstasy and cocaine.
- Among 'recreational' users, reported subjective negative effects were more frequently associated with new psychoactive substances in powder form than with such substances in tablet form. Powders were associated with memory loss/blackouts in particular. Palpitations were associated with both powder-form and tablet-form substances, and these palpitations seem to have been especially worrying for some users.
- It appears that some individuals expect negative effects from new psychoactive substance use, while others do not. Almost 40% of those reporting memory loss/blackouts in the current study said they anticipated this effect. It is possible that the unexpected nature of various negative effects may have contributed to the discomfort or distress experienced by some users. While two interviewees reported surprising and distressing effects after taking *Salvia divinorum* for the first time, they reported more favourable experiences after taking it on subsequent occasions.
- Although 'recreational' users of new psychoactive substances experienced negative effects, they did not appear to be seeking medical or psychological help as a result.
- Only three survey respondents (1.5%) had accessed emergency medical services as a result of the use of new psychoactive substances.
- The extent to which recreational users engage in behaviours intended to minimise harm related to the use of new psychoactive substances is unclear, but it is likely that such behaviours may be more common among more experienced drug takers.

Risk factors associated with the use of new psychoactive substances

The following points are highlighted in the context of considering the potential risks associated with the use of new psychoactive substances:

- Users of new psychoactive substances may inadvertently engage in criminal behaviour if they purchase a supposedly legal substance which actually contains a controlled substance. This may especially be the case with online purchases, which may contain controlled substances, despite purporting otherwise.
- The lack of consistency between the advertised content and the actual content of some new psychoactive substance products may increase the likelihood of misuse and overdose. In addition, a lack of consistency in the active content of individual products over time may put users at risk of misusing the substance, or of overdosing.
- The combination of substances contained in individual products creates a potential risk of problematic drug interactions.
- There is little information available on the safety or toxicity of new psychoactive substances. In addition, guidelines on dosage are unclear, thus potentially increasing the likelihood of overdose.
- The lack of knowledge about the toxicity and effects of new psychoactive substances may mean that harm-reduction options are not always clear.
- The lack of information regarding new psychoactive substances makes it difficult to suggest specific harm-reduction advice to users. In the absence of the requisite knowledge, harm-reduction advice relating to the use of stimulants and cannabis may be appropriate.

- The absence of reference standards for new psychoactive substances means that toxicological analysis can be difficult.
- The abuse potential of many new psychoactive substances is as yet unknown.

Legal responses

- The Criminal Justice (Psychoactive Substances) Act 2010 is unique in its approach to addressing the issue of new psychoactive substances. Its introduction has coincided with a sharp reduction in the number of head shops in Ireland.

Conclusions and recommendations

1. A challenge may exist in relation to the monitoring of online outlets for the sale and supply of new psychoactive substances. In terms of further addressing the issue, efforts could be made to examine existing models of online monitoring which may curtail such trade, including, for example, the model of co-operation in place between the Irish Medicines Board and the Customs authorities to monitor the sale of counterfeit medicines.
2. Given Ireland's close proximity to/cultural links with the UK, it should collaborate more closely with UK initiatives, and it should also collaborate with other EU countries to put in place measures to restrict access to new psychoactive substances.
3. The 'Hospital Emergency Departments' component of this study is as yet incomplete. However, preliminary contacts indicate that there is no readily accessible database of 'presenting issues' in relation to hospital emergency departments. The lack of such information makes it impossible to quantify the harm being caused by existing and newly emerging synthetic chemicals. It is recommended that any relevant information collected at local hospital level be stored centrally in an appropriate agency such as the Health Research Board (HRB); the Economic and Social Research Institute (ESRI), which details hospital admissions each year; or in the National Advisory Committee on Drugs (NACD). The implementation of such a measure would result in creating a clearer, empirical picture of the harm being caused by head shop products and it would replace the current practice of relying on anecdotal reports.
4. A system of routine reporting of new psychoactive substances intoxication to the National Poisons Information Centre is recommended, in order to facilitate the building of a knowledge base.
5. The survey results show that many users report strong negative reactions following ingestion of 'legal highs'; the results also indicate the existence of a vibrant online community of (mostly) young people who are willing to experiment with and discuss new psychoactive substances. In contrast, the public health message about the risks/dangers of 'legal highs' is rather muted, particularly in the online fora frequented by young people. The authors of this report recommend a much more dynamic stating of the risks of 'legal highs' on the various online media outlets used by young people; this would include advertising on Facebook, actively engaging with threads in chat rooms and so on.
6. Given the level of polydrug use reported by survey respondents, it is recommended that interventions be designed to specifically target this pattern of substance abuse.

7. Initial indications are that drug consumption choices and patterns of use are shifting in response to recent legislative changes. It is recommended that the impact of these changes be monitored and assessed, so that any new risks that may emerge can be identified, and appropriate responses developed.

8. Ireland does not have a specific research laboratory dedicated to the monitoring of developments in new psychoactive substances. The potential exists for the establishment of a dedicated laboratory where rigorous testing of new and emerging psychoactive substances could be carried out – a laboratory which has sufficient time and manpower resources to regularly test for features such as purity and concentration in any new product that appears on the market.

9. The availability of reference standards for new psychoactive substances is limited. The companies providing these standards charge premium rates, possibly due to lack of competition in this area. In addition, the time frame required in order to procure reference standards can be prohibitive. In some cases, a licence must be obtained for the particular substance before a reference standard can be ordered; delivery time thereafter may take a number of weeks. There is scope for the establishment in Ireland of a reference standards body/company which could respond rapidly as new substances appear on the market. This reference standards body could provide a dedicated service not just to Ireland but to other EU countries, thus providing a continent-wide service/resource to address the issue of newly emerging psychoactive substances.

10. The continuation of a pragmatic public health approach to new psychoactive substances is recommended. Despite historical efforts to control a variety of substances, these substances have consistently been available through illegal suppliers. In keeping with the public health approach, a number of broad harm-reduction measures are suggested; these are outlined in section 4.2 of this report.

Introduction

Head shop retail outlets supplying non-regulated substances have recently come to public attention in Ireland, thereby sparking considerable media and political debate about the potentially hazardous effects of these substances. Their widespread availability is also of concern to governments across Europe and elsewhere, due to the unpredictable side effects and lack of quality control of such substances. In addition, the European Monitoring Centre on Drugs and Drug Addiction (EMCDDA) has recently highlighted the need to step up national-level data collection on such substances, particularly those containing cathinones and synthetic cannabinoids. The substances come from unregulated sources, and are frequently described as 'research chemicals' which have no medicinal application.

The recreational use of new psychoactive substances has been increasing in parallel with developments such as greater economic globalisation and freer, de-regulated supply chains. Both non-regulated substances and controlled substances are a source of insecurity and uncertainty in the face of Ireland's exposure to global supply chains. Moreover, both types of substances pose potential risks to users, as evidenced by the volume of anecdotal accounts of negative side effects following consumption of these substances. Head shops tend to be located in busy areas of cities and towns, and particularly in areas associated with the leisure industry and the night-time economy.

It appears that certain groups of users, most notably current problem drug users, are especially at risk. In addition, there is concern about the wider public health issue and the social risks associated with problem drug use. For these reasons, national-level action is required to improve existing knowledge and thus enable appropriate public policy and timely interventions. The authors of this document are endeavouring to make a significant contribution in this respect.

The report was commissioned by The National Advisory Committee on Drugs (NACD) in accordance with Action 14 of the National Drugs Strategy (interim) 2009–2016, which provides for the monitoring of head shops and other outlets for the sale of psychoactive substances, under the Misuse of Drugs Act 1977, and the Misuse of Drugs (Amendment) Regulations 2007. The review aims to provide an overview of new psychoactive substances in Ireland, which were not at the time subject to national legal controls, and to review the outlets supplying these substances.

The review was undertaken by a research team at Dublin Institute of Technology (DIT) who mobilised expertise from both the scientific field and the social sciences field. The scientific input was provided by personnel from the School of Chemical and Pharmaceutical Sciences, and the social scientific input was provided by researchers at the Centre for Social and Educational Research (CSER), which operates under the aegis of the School of Social Sciences and Law.

This document contains the review findings, and is structured as follows:

- A review of products sold in head shops and other outlets.
- Information in relation to retail outlets for new psychoactive substances in Ireland.
- A review of published data relating to new psychoactive substances and their effects. Data providing insights into user experience of new psychoactive substances.
- Assessment of risk factors associated with the use of new psychoactive substances. Suggestions for harm-reduction measures to minimise risks for users.
- Information regarding the availability of reference standards to facilitate the analysis of new psychoactive substances.
- An overview and analysis of measures taken in other jurisdictions to restrict psychoactive substances including, where relevant, information regarding the legislative framework used to regulate, restrict, or control the substance concerned and/or the outlet supplying such products.
- Conclusions and recommendations.

1 A review of products sold in head shops and online

The review of products sold in head shops and online was undertaken in order to:

- identify new psychoactive substances currently available on the Irish market;
- establish (where possible) the psychoactive compounds present in a range of new psychoactive substances (including powders, tablets/capsules, and herbal material) purchased in Irish head shops and online;
- assess the consistency of psychoactive content over time; and
- establish the nature and extent of information provided on product packaging.

The proliferation of 'head shops' in Ireland has led to the creation of an alternative drug market. 'Head shops', also known as 'smart shops', 'hemp shops', 'hemporia', and 'grow shops', have been defined as retail outlets 'specialising in drug paraphernalia related to the consumption of various recreational drugs (cannabis bongs, glass pipes etc)' (Ballyfermot Drugs Task Force, 2010). Head shops have moved from stocking and selling paraphernalia to also stocking and selling 'new psychoactive substances', formerly known as 'legal highs'. These substances are often marketed as 'bath salts', 'plant feeder', 'incense', 'pot pourri', or 'dust absorbers', and are often labelled as 'not for human consumption', in an effort to circumvent control measures.

The first head shop in Ireland opened in 2000 and stocked drug paraphernalia. Two years later, a loophole in the legislation saw head shop owners selling fresh/raw magic mushrooms[5]. This loophole was subsequently closed in 2004, placing fresh/raw magic mushrooms under the Misuse of Drugs Act 1977. In the same year, the Dublin Head Shop in Temple Bar opened, and was still trading at the time this review was being carried out. In another step towards controlling the sale of new psychoactive substances, the Government introduced a Government Declaration Order in March 2009, thus scheduling 1-benzylpiperazine (BZP) as a controlled substance under the Misuse of Drugs Acts.

In May 2010, the Minister for Health and Children announced an Order declaring a number of new psychoactive substances controlled under the Misuse of Drugs Act 1977. The Order was introduced with immediate effect and covered synthetic cannabinoids (those contained in 'Spice' and related herbal smoking products), piperazines other than BZP and also, mephedrone, methylone, methedrone, butylone, flephedrone and 3,4-methylenedioxypyrovalerone (MDPV) (Department of Health and Children, 2010). The number of head shops in Ireland prior to the May 2010 Order stood at over 100, but by July 2010, 39 head shops nationwide were operational. On 4 October 2010, the number of head shops open had decreased to ten.

Head shop products may contain a potentially vast range of substances, and the products themselves come in various formats. Powders may be marketed as 'party powder' or 'party snuff'; pills (tablets/capsules) may be marketed as 'party pills', 'herbal pills', and 'legal highs'; and smoking products may be marketed as 'smoking herbs', 'smoking mixtures', 'smoking blends', 'incense' or 'pot pourri'. Head shops may also stock cacti, mushrooms, seeds and other plant material which may have psychoactive properties. Substances for sale in head shops are often marketed and packaged to mimic illicit drugs such as cocaine and ecstasy. A case in point is the product 'Hurricane Charlie', which features three lines of white powder on its packaging.

5 While dried mushrooms were covered by the Misuse of Drugs Act, there was a potential loophole in the legislation in relation to the sale of fresh/raw mushrooms.

While many consumers of head shop products may suffer from the misconception that such products are 'safe' because they are legal and because they can be purchased in shops, the reality is that very little is known about many of these products and the substances they contain. To date, limited data have been produced on the head shop products available in Ireland, and work has only recently begun on the process of identifying these products and the substances they contain (Kavanagh *et al.*, 2010a, 2010b, 2010c, 2010d, 2010f).

New psychoactive substances available in head shops and online are not regulated and therefore do not undergo the normal stringent safety and quality control testing that is necessary in products that are for human consumption. Little is also known about the quality and type of product information provided to consumers of head shop products. Studies in Ireland and elsewhere have begun to examine this information (Davies *et al.*, 2010; Pillay and Kelly, 2010; Schmidt, Sharma, Schifano and Feinmann, 2010).

1.1 Psychoactive substances

According to the World Health Organization, a psychoactive substance is:

> "a substance that, when ingested, affects mental processes e.g. cognition or affect. This term and its equivalent, psychotropic drug, are the most neutral and descriptive terms for the whole class of substances, licit and illicit, of interest to drug policy. 'Psychoactive' does not necessarily imply dependence-producing, and in common parlance, the *term* is often left unstated, as in 'drug use' or 'substance abuse'" (WHO, 2010).

For the purposes of the Criminal Justice (Psychoactive Substances) Act 2010:

> 'psychoactive substance means a substance, product, preparation, plant, fungus or natural organism which has, when consumed by a person, the capacity to-
>
> a. produce stimulation or depression of the central nervous system of the person, resulting in hallucinations or a significant disturbance in, or significant change to, motor function, thinking, behaviour, perception, awareness or mood, or
>
> b. cause a state of dependence, including physical or psychological addiction'
>
> (Criminal Justice' (Psychoactive Substances) Act 2010, p 4).

The Act itself has exclusions: some psychoactive substances are used for a legitimate purpose such as in medicines (e.g. codeine and caffeine).

According to Article 3 of Council Decision 2005/387/JHA of 10 May 2005 on the information exchange, risk assessment and control of new psychoactive substances:

> "'new psychoactive substance' means a new narcotic drug or a new psychotropic drug in pure form or in a preparation; 'new narcotic drug' means a substance in pure form or in a preparation, that has not been scheduled under the 1961 United Nations Single Convention on Narcotic Drugs, and that may pose a threat to public health comparable to the substances listed in Schedule I, II or IV; 'new psychotropic drug' means a substance in pure form or in a preparation that has not been scheduled under the 1971 United Nations Convention on Psychotropic Substances, and that may pose a threat to public health comparable to the substances listed in Schedule I, II, III or IV".

Psychoactive substances that have been documented in Irish head shop products before and after the ban include the following[6]:

- Synthetic cannabinoids.
- BZP (1-benzylpiperazine) and piperazine derivatives.
- Mephedrone, methylone, methedrone, butylone, flephedrone, MDPV, methcathinone, naphyrone, ethcathinone, dimethocaine, dimethylamylamine (DMAA), dimethylcathinone, 2-phenylethylamine, fluorotropacocaine, desoxypipradrol, benzedrone, pentylone.

There are few formal pharmacokinetic or pharmacodynamic studies published in relation to new psychoactive substances. In addition, there are few published studies assessing the psychological or behavioural effects of many of these psychoactive substances in humans. Therefore any psychological and/or behavioural effects related to these psychoactive substances are based heavily on users' reports and/or clinical reports of psychoactive substance toxicity (Europol-EMCDDA, 2010). Chemical data in relation to new psychoactive substances is also limited. What follows is a synopsis of the chemical knowledge available on piperazine, piperazine derivatives, cathinones, cathinone derivatives, pyrovalerones, naphthylpyrovalerones, synthetic cocaine, synthetic cannabinoids and other emerging psychoactive substances.

1.2 Piperazines and piperazine derivatives

Aryl-substituted piperazines are dibasic amines with no stereoisomers. They include the subgroup of benzylpiperazines and phenylpiperazines, as listed below. These are entirely synthetic substances and are not derived or synthesised from the pepper plant, as often incorrectly reported, possibly due to the fact that piperine (an unrelated substance) is a constituent of black pepper *(Piper nigrum)*. Piperine has also been found in the ingredients of head shop products, and is possibly included in the product in order to assist absorption of the pyschoactive substance into the bloodstream. Piperazine derivatives are often found in psychoactive products (antihistamines and antipyschotics) in tablet/capsule form and in powders.

The common and indeed large-scale misuse of piperazine derivatives was first seen in New Zealand. A substance that was marketed as a legal alternative to ecstasy, BZP (1-benzylpiperazine), was marketed as 'safe' and 'legal' and had been branded as a 'party pill' by Matt Bowden[7] in New Zealand in 1999. Bowden and his company, Stargate, recorded an annual domestic turnover of approximately 16 million euro in 2007 alone (Clark, 2007). It was estimated that every month in 2005 approximately 150,000 doses of party pills were sold in New Zealand. Europe began to experience BZP usage from 2004 onwards (EMCDDA, 2010a).

BZP is not contained in any licensed medicinal products currently used in the EU; neither is it contained in any licensed human or veterinary pharmaceutical products currently used in any EU country.

Tables 1.0–1.1 below illustrate the range of piperazine derivatives that are known to exist. It should be noted that not all the piperazine derivatives listed below have either been abused as 'designer drugs' or encountered in forensic testing of psychoactive products. The piperazine derivatives that have been encountered as psychoactive drugs are indicated by an asterisk.

6 See Kavanagh and colleagues (2010a; 2010b; 2010c) and the current review.

7 Matt Bowden (New Zealand) is not to be confused with Matt JK Bowden, one of the co-authors of this report.

Table 1.0: 1-Benzylpiperazines (adapted from EMCDDA, 2010a)

Name (acronym)	R^4
1-Benzylpiperazine (BZP)*	H
1-Benzyl-4-methylpiperazine (MBZP)*	Methyl
1,4-Dibenzylpiperazine (DBZP)*	C_6H_5-CH_2

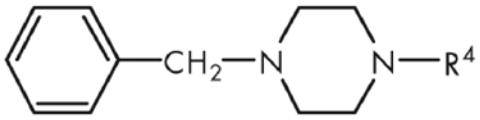
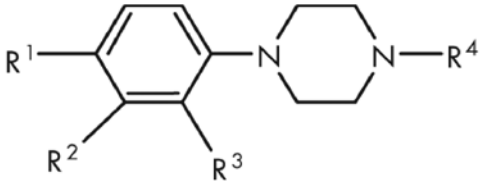


Table 1.1: 1-Phenylpiperazines

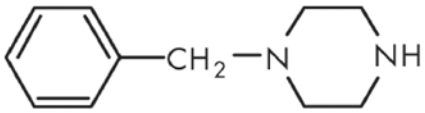
(Adapted from EMCDDA, 2010a)

Name (acronym)	R^1	R^2	R^3	R^4
1-(3-Chlorophenyl)-4-(3-chloropropyl) piperazine (*m*CPCPP)	H	Cl	H	CH_2CH_2-CH_2Cl
1-(3-Chlorophenyl) piperazine (*m*CPP)*	H	Cl	H	H
1-(4-Chlorophenyl) piperazine (*p*CPP)	Cl	H	H	H
1-(4-Fluorophenyl) piperazine (*p*FPP)*	F	H	H	H
1-(2-Methoxyphenyl) piperazine (oMeOPP)	H	H	MeO	H
1-(4-Methoxyphenyl) piperazine (*p*MeOPP)	MeO	H	H	H
1-(3-Methylphenyl) piperazine (*m*MPP)	H	Methyl	H	H
1-(4-Methylphenyl) piperazine (*p*MPP)	Methyl	H	H	H
1-(3-Trifluoromethylphenyl) piperazine (TFMPP)*	H	CF_3	H	H



BZP

Molecular structure: 1-benzylpiperazine (BZP)



Molecular formula: $C_{11}H_{16}N_{20}$
Molecular weight: 176.3 g/mol

Mass spectral data (*m/z*): 91 (base peak), 134, 56, 176, 65.

CAS #: 2759-28-6

BZP is available as a base (pale, slightly yellowish/green) or a hydrochloride salt (white solid). The base is corrosive and can cause burns; hydrochloride salt is an irritant, affecting the eyes, respiratory system and skin.

BZP was developed as a potential antidepressant drug by Wellcome. However, due to its similar effects to d-amphetamine, the drug was never developed commercially. BZP is a central nervous system (CNS) stimulant, with approximately 10% of the potency of d-amphetamine. Alternative chemical names for BZP are as follows: 1-benzyl-1,4-diazacyclohexane, N-benzylpiperazine and, less precisely, benzylpiperazine. The street terminology for BZP includes 'A2', 'Legal X' and 'Pep X'.

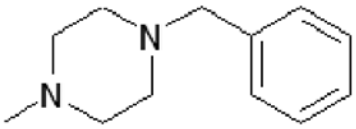
While BZP belongs to a small group of benzyl-substituted piperazines (as can been seen in Table 1.0), the phenylpiperazines listed in Table 1.1 actually constitute a much larger group. At the end of 1999 BZP was added to the list of new psychoactive substances monitored by Europol and the EMCDDA via the Early Warning System (EWS). It is believed that recreational use of BZP began around the mid 1990s in California (EMCDDA, 2010a). The purity of BZP available from suppliers on the Internet is in the range of 99-99.8%, and thus very high. The typical dose of BZP found in these products is in the order of 50-200mg.

Information provided to the EMCDDA in The Europol-EMCDDA Joint Report on a new psychoactive substance: 1-benzylpiperazine (BZP) stated that Ireland along with other EU countries detected BZP in the form of tablets and capsules in 2006. Experts in other countries documented detection of BZP in both powder form and paste form. It was noted that in Ireland BZP was seized in combination with TFMPP, whereas other countries noted seizures of BZP in addition to MeOPP, mCPP, DBZP, cocaine, caffeine, 2-PEA and MDMA. The Forensic Science Laboratory in Ireland also carried out analysis of samples taken from a head shop. In their analysis of 56 pink capsules, they found BZP and MPP. A total of 100 capsules (various colours) contained BZP and TFMPP; six red capsules contained BZP and caffeine, and two blue half-scored tablets with a 'lightning flash' design contained BZP only. Recent evidence suggests that the combination of BZP with TFMPP mimics some of the effects of MDMA (ecstasy) (Baumann, 2005).

BZP can be synthesised by reacting piperazine monohydrochloride with benzyl chloride. Benzyl chloride is readily available and piperazine monohydrochloride is shown to be easily produced from commercially available salts. In addition, DBZP (1, 4-dibenzylpiperazine) is known to be a side-product of this reaction.

MBZP

Molecular structure 2: 1-Benzyl-4-methylpiperazine



Molecular formula: $C_{12}H_{18}N_2$
Molecular weight: 190.3 g/mol

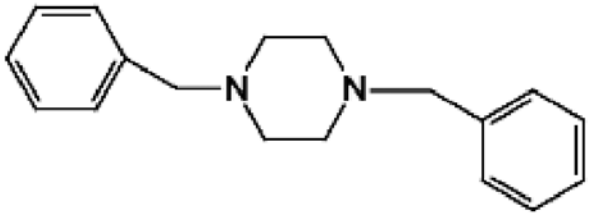
Mass spectral data (*m/z*): 91 (base peak), 190, 119, 99, 56.

CAS #: 374898-00-7

MBZP is a derivative of BZP, but its stimulant ability is considered to be slightly weaker.

DBZP

Molecular structure: 1, 4-Dibenzylpiperazine



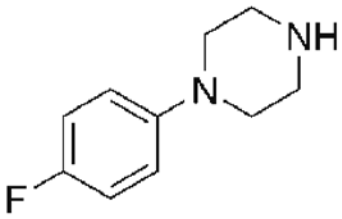
Molecular formula: $C_{18}H_{22}N_2$
Molecular weight: 266 g/mol

CAS #: 2298-55-7

DBZP is a side-product during the synthesis of BZP and, as such, 'legal highs' that show the presence of DBZP could be as a result of a synthetic impurity. It may be indicative of low quality or poorly made BZP.

pFPP

Molecular structure: p-fluorophenylpiperazine, 1-(4-fluorophenyl) piperazine



Molecular formula: $C_{10}H_{13}FN_2$
Molecular weight: 180.2 g/mol

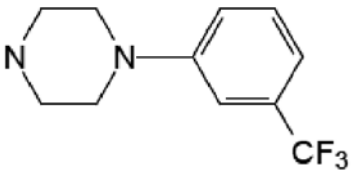
CAS #: 2252-63-3

pFPP was originally discovered as a metabolite of niaprazine, a hypnotic antihistamine, in 1982. However, from 2003 onwards pFPP was used and sold as 'party pills' in New Zealand. Researchers have shown that pFPP in large doses produces a behavioural syndrome indicative of serotonergic stimulation (Keane, Strolin, Benedetti and Dow, 1982).

The California Department of Justice Laboratory analysed 12 red 'Playboy Bunny' tablets, which it was suspected were, in fact, ecstasy tablets. However, following GC/MS analysis, fluorophenylpiperazine (pFPP) was identified. The laboratory had previously received numerous BZP/TMFPP ecstasy mimic tablets, but this was the first time pFPP was identified in analyses (US DEA Microgram Bulletin, 2009).

TFMPP

Molecular structure: 1-(3-Trifluoromethylphenyl) piperazine



Molecular formula: $C_{11}H_{13}F_3N_2$
Molecular weight: 230 g/mol

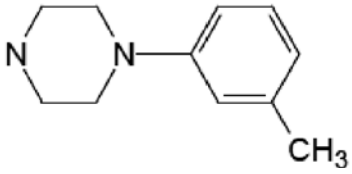
Mass spectral data (*m/z*): 188 (base peak), 230, 172, 145.

CAS #: 15532-75-9

After mCPP, TFMPP is the most common substituted piperazine. This particular substituted piperazine is nearly always seen in combination with BZP. Research indicates that BZP in conjunction with TFMPP mimics the effects of MDMA, and that TFMPP effects, when taken alone, are neither well documented nor known. However, some sources state that TFMPP has properties similar to the stimulant effects of ecstasy, but when taken in larger doses, it promotes hallucinogenic reactions (US DEA Safety Advisory, 2003). Arizona, Kansas and Ohio all documented seizures of ecstasy-mimicking tablets containing BZP/TFMPP in May 2009 (US DEA Microgram Bulletin, 2009).

mMPP

Molecular structure: 1-(3-methylphenyl) piperazine



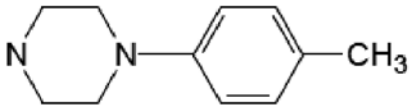
Molecular formula: $C_{11}H_{16}N_2$
Molecular weight: 176 g/mol

CAS #: 41186-03-2

There is very little published information on mMPP.

pMPP

Molecular structure: 1-(4-methylphenyl) piperazine



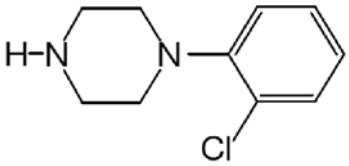
Molecular formula: $C_{11}H_{16}N_2$
Molecular weight: 176 g/mol

CAS #: 39593-08-3

No published information could be sourced on pMPP.

oCPP

Molecular structure: 1-(2-chlorophenyl) piperazine



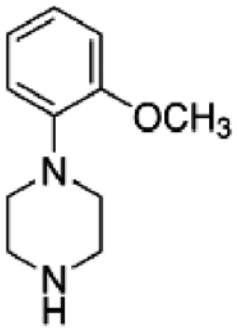
Molecular formula: $C_{10}H_{13}ClN_2$
Molecular weight: 196.5 g/mol

CAS #: 39512-50-0

Limited information has been published on the properties of the positional isomers (i.e. oCPP and pCPP).

oMeOPP

Molecular structure: 1-(2-methoxyphenyl) piperazine



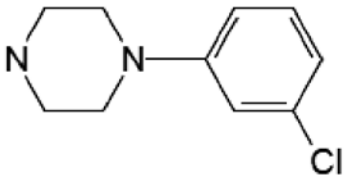
Molecular formula: $C_{11}H_{16}N_{2O}$
Molecular weight: 192 g/mol

CAS #: 35386-24-4

There is limited published information available on oMeOPP.

mCPP

Molecular structure: 1-(3-Chlorophenyl) piperazine



Molecular formula: $C_{10}H_{13}ClN_2$
Molecular weight: 196.7 g/mol

Mass spectral data (*m/z*): 154 (base peak), 196, 156, 56 and 138. (However, mass spectrometry does not distinguish mCPP from its isomers (oCPP and pCPP).

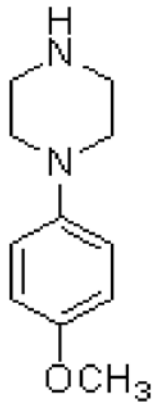
CAS #:51639-49-7

mCPP is used in the synthesis of a number of antidepressant drugs, such as Trazodone. mCPP has been documented as being far more widespread than BZP. It has been estimated that almost 10% of the illicit tablets sold in the EU as part of the illicit ecstasy market contained mCPP. In fact, this figure appears to have increased substantially to 50% in some EU countries between 2008 and 2009. During 2008 it became commonplace to see mixtures of piperazine derivatives. Notably, however, combinations of BZP, TFMPP, mCPP and DBZP were more abundant. In addition, mixtures with amphetamine, cocaine, ketamine and MDMA have also been observed.

The synthesis of mCPP can be achieved through the reaction of diethanolamine with m-chloroaniline. It is also possible to synthesise mCPP via a reaction of m-chloroaniline with bis (2-chloroethyl) amine or by reacting piperazine with m-dichlorobenzene (EMCDDA, 2010a).

pMeOPP

Molecular structure: 1-(4-methoxyphenyl) piperazine



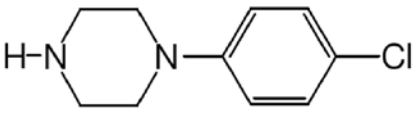
Molecular formula: $C_{11}H_{16}N_{2O}$
Molecular weight: 192 g/mol

CAS #: 38212-30-5

There is limited published information available on pMeOPP.

pCPP

Molecular structure: 1-(4-chlorophenyl) piperazine



Molecular formula: $C_{10}H_{13}ClN_2$
Molecular weight: 192 g/mol

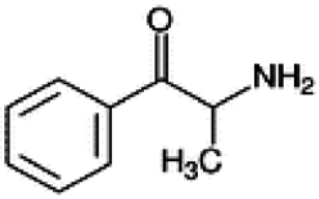
CAS #: 38212-33-8

As noted earlier, some of the illicit tablets that have been encountered contained pCPP. When compared with mCPP, neither pCPP nor oCPP have found significant use as probes of 5HT receptors. According to Fuller and Snoddy (1980), pCPP increases serotonin levels in rat brains but, unlike pchloroamphetamine, caused no long-term depletion of 5-hydroxyindoleacetic acid. (EMCDDA, nd)

1.3 Cathinones and cathinone derivatives

Cathinone

Molecular structure: 2-amino-1-phenyl-1-propanone



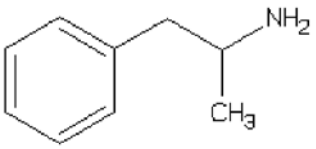
Molecular formula: $C_9H_{11}NO$
Molecular weight: 149 g/mol

CAS #: 71031-15-7

Cathinone is one of the principal psychoactive components of the Khat plant (*Catha edulis*). Cathinone, also known as benzoylethanamine, is a naturally occurring analogue of ampthetamine. However, cathinone differs from amphetamine in that it has the presence of a benzylic keto group (Dal Cason, Young and Glennon, 1997a). The structure of amphetamine is shown below to illustrate the structural comparison with cathinone.

Amphetamine

Molecular Structure: 1-phenylpropan-2-amine



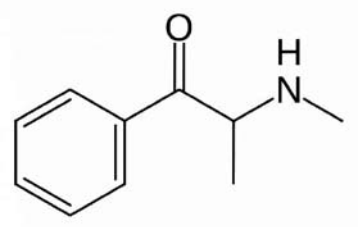
Molecular formula: $C_9H_{13}N$
Molecular weight: 135 g/mol

CAS #: 96332-84-2

The EMCDDA and Europol are currently monitoring 15 synthetic cathinones, 'designer' compounds which are the derivatives of cathinone.

Methcathinone

Molecular structure: 2-(methylamino)-1-phenyl-1-propanone



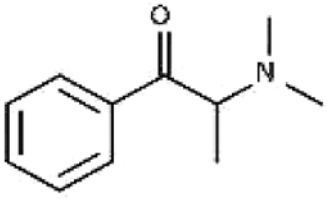
Molecular formula: $C_{10}H_{13}NO$
Molecular weight: 163 g/mol

CAS #: 5650-44-2

Methcathinone has been shown to be approximately twice as potent as cathinone. Methcathinone was first identified in 1982 in Leningrad as it was a popular drug of abuse in the former Soviet Union, where it was termed ephedrone. Methcathinone has been found to possess two optical isomers, both of which are active. However, research has demonstrated that the S (-) methcathinone is up to five times more potent than the R (+) methcathinone (Dal Cason *et al.*, 1997a).

Dimethylcathinone

Molecular structure: 2-(dimethylamino)-1-phenyl-1-propanone



Molecular Formula: $C_{11}H_{15}NO$
Molecular weight: 177 g/mol

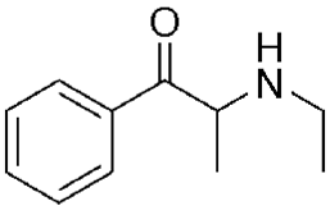
CAS #: 15351-09-4

Dimethylcathinone is also known as Metamfepramone and Dimethylpropion. (2S)-(-)-Dimethylcathinone can be synthesized from (1R,2S)-(-)-N-methylephedrine by oxidation with potassium permanganate or any of a variety of chromium compounds, most often sodium or potassium dichromate. Alternatively, racemic dimethylcathinone can be prepared from 2-bromopropiophenone by reacting with dimethylamine (Dal Cason, 2007).

The sympathomimetic agent metamfepramone (2-dimethylamino-1-phenylpropan-1-one, dimethylpropion) has stimulating properties and a rapid metabolism, resulting in major degradation products such as methylpseudoephedrine and methcathinone. It has been considered for doping controls by the World Anti-Doping Agency (WADA) (Thevis, Sigmund, Thomas, Gougoulidis, Rodchenkov and Schänzer, 2009).

Ethcathinone

Molecular structure: 2-(ethylamino)-1-phenyl-1-propanone



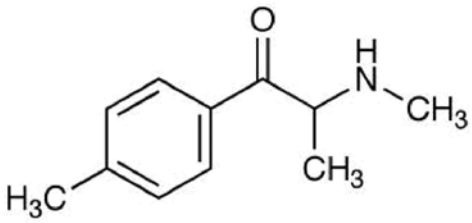
Molecular formula: $C_{11}H_{15}NO$
Molecular weight: 177 g/mol

CAS #: 51553-17-4

Ethcathinone is also known as ethylpropion.

Mephedrone

Molecular structure: 2-(methylamino)-1-(4-methylphenyl)-1-propanone



Molecular formula: $C_{11}H_{15}NO$
Molecular weight: 177.242 g/mol

CAS # 1189805-46-6 (base); 1189726-22-4 (hydrochloride salt).

Mass spectra data (*m/z*): 58 (base peak). (Note: mass spectra as a technique is not capable of distinguishing between methylmethcathinone isomers e.g. 4-methylmethcathinone from 3-methylmethcathinone).

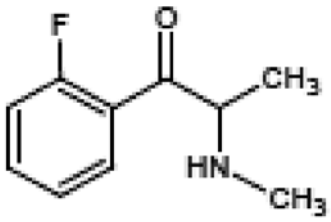
Mephedrone HCl salt is a white powder, whereas mephedrone in its free base is a yellowish liquid. The purity of mephedrone is often very high, in the region of approximately 99%. Mephedrone (4-methylmethcathinone) is the para-methyl derivative of methcathinone. In 2008, mephedrone was reported for the first time to the EMCDDA's Early Warning System, from Finland. Street names for mephedrone include; MMC, 4MMC, M-CAT, MMCAT or Subcoca-1.

Mephedrone is marketed as a 'legal high' and a 'legal alternative to cocaine or ecstasy', on the Internet, where it is readily available. Suppliers have marketed mephedrone as 'bath salts', 'plant feeder', 'plant food' or a 'research chemical' and 'not for human consumption'. The packaging rarely implies the presence of a psychoactive substance in the list of ingredients, where a list exits: often there is none (Europol-EMCDDA, 2010; Gibbons and Zloh, 2010; Psychonaut WebMapping Research Group, 2009).

Mephedrone is most likely to be synthesised via the bromination of 4-methylpropiophenone.

2-Fluoromethcathinone

Molecular structure: 1-(2-fluorophenyl)-2-(methylamino)-1-propanone



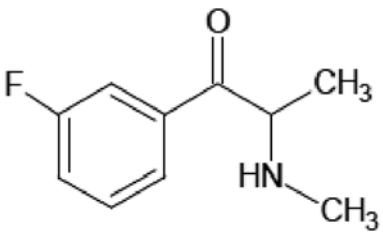
Molecular formula: $C_{10}H_{12}FNO$
Molecular weight: 181 g/mol

CAS #: Unknown

There is limited published information on 2-fluoromethcathinone.

3-Fluoromethcathinone

Molecular structure: 1-(3-fluorophenyl)-2-methylamino)-1-propanone



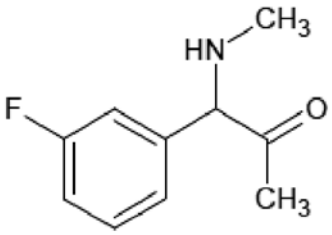
Molecular formula: $C_{10}H_{12}FNO$
Molecular weight: 181 g/mol

CAS #: 1049677-77-1

There is limited published information on 3-fluoromethcathinone.

3-Fluoro-iso-methcathinone

Molecular structure: 1-(3-fluorophenyl)-1-(methylamino)-2-propanone

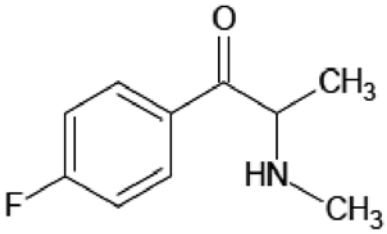


Molecular formula: $C_{10}H_{12}FNO$
Molecular formula: 181 g/mol

CAS #: Unknown

4-Fluoromethcathinone

Molecular structure: 1-(4-fluorophenyl)-2-(methylamino)-1-propanone



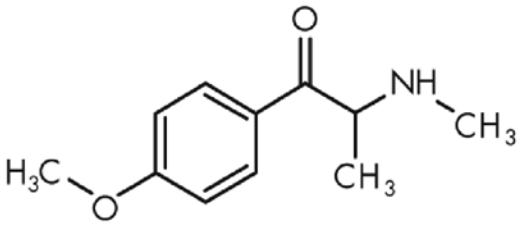
Molecular formula: $C_{10}H_{12}FNO$
Molecular weight: 181 g/mol

CAS #: 7589-35-7

4-Fluoromethcathinone is also known as flephedrone.

Methedrone

Molecular structure: 1-(4-methoxyphenyl)-2-(methylamino)-1-propanone



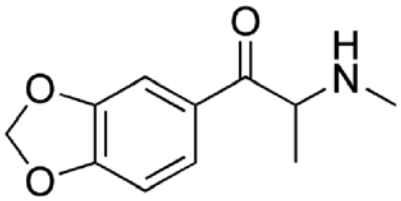
Molecular formula: $C_{11}H_{15}NO_2$
Molecular weight: 193 g/mol

CAS #: 530-54-1

Methedrone is also known as ßk-PMMA and 4-methoxymethcathinone.

Methylone

Molecular structure: 2-methylamino-1-(3,4-methylenedioxyphenyl)-1-propanone



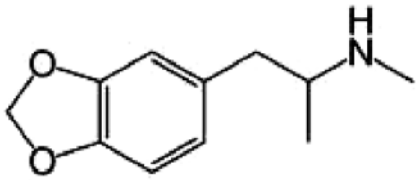
Molecular formula: $C_{11}H_{13}NO_3$
Molecular weight: 207 g/mol

CAS#: 186028-79-5

Methylone is also known as bk-MDMA. It was originally patented by Jacob and Shulgin in 1996 as an antidepressant. Methylone is a close structural analogue of MDMA, differing by the addition of a ß-ketone group.

MDMA

Molecular structure: 3,4-Methylenedioxymethamphetamine



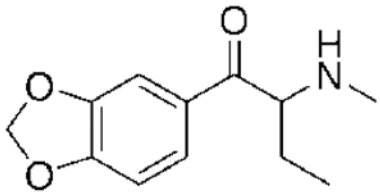
Molecular formula: $C_{11}H_{15}NO_2$
Molecular weight: 193 g/mol

CAS #: 42542-10-09

MDMA is also known as ecstasy and is a derivative of amphetamine. It was developed by Merck in 1912 with a view to its potential use in psychiatric counselling. However, its use in this field has been extremely limited. MDMA is a CNS stimulant with weak hallucinogenic capabilities (EMCDDA, 2010c). The first recorded recreational use of MDMA was in 1972 (Laing and Seigl, 2003). MDMA is often found in tablet form (normally displaying a logo of some description) on the illicit market and is under international control. It has two enantiomeric forms (R and S) and contained in its hydrochloride salt is a white powder or crystals. Tablets have been found to contain approximately 60-70 mg of either the hydrochloride salt or phosphate salt of MDMA (EMCDDA, 2010c).

Butylone

Molecular structure: 1-(1,3-benzodioxol-5-yl)-2-(methylamino)-1-butanone



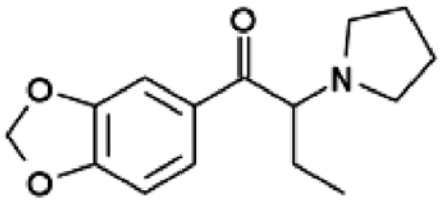
Molecular formula: $C_{12}H_{15}NO_3$
Molecular weight: 221 g/mol

CAS#: 17762-90-2

Butylone is also known as ßk-MBDB (the ß-keto analogue of methylbenzodioxylbutanamine). Butylone is also closely related to ethylone and methylone. Butylone acts as an entactogen, psychedelic and stimulant. It was first synthesised by Koeppe, Ludwig and Zeile in 1967 (Deprez, 2009).

MDPBP

Molecular structure: 3',4'-Methylenedioxy-α-pyrrolidinobutiophenone



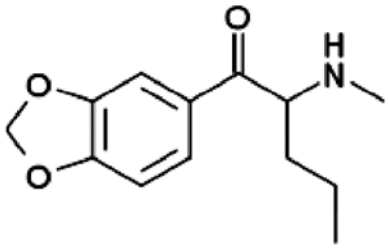
Molecular formula: $C_{15}N_{19}NO_3$
Molecular weight: 261 g/mol

CAS #: unknown

There is very limited published information available on MDPBP.

Pentylone

Molecular structure: ß-Keto-Methylbenzodioxolylpentanamine



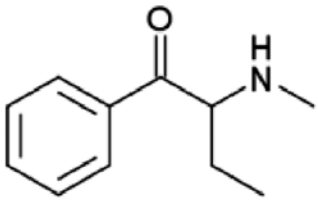
Molecular formula: $C_{13}H_{17}NO_3$
Molecular weight: 235 g/mol

CAS #: 698963-77-8

There is limited published information on pentylone.

Buphedrone

Molecular structure: 2-(methylamino)-1-phenylbutan-1-one



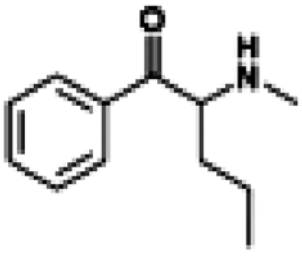
Molecular formula: $C_{11}H_{15}NO$
Molecular weight: 177 g/mol

CAS #: 408332-79-6

There is limited published information on buphedrone.

Pentedrone

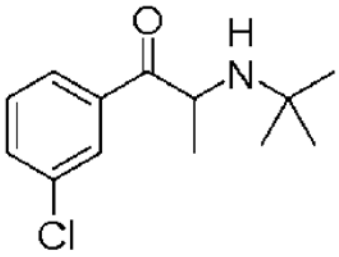
Molecular structure: 1-phenyl-2-methylamino-pentan-1-one



There is no published information available on pentedrone.

Bupropion

Molecular structure: 2-(*tert*-butylamino)-1-(3-chlorophenyl) propan-1-one



Molecular formula: $C_{13}H_{18}ClNO$
Molecular weight: 240 g/mol

CAS #: 34841-39-9

Bupropion is also known as Wellbutrin®, Zyban®, Voxra®, Budeprion®, or Aplenzin®; it was formerly known as amfebutamone. The INN (International Nonproprietary Names)[8] originally assigned in 1974 by the World Health Organization was 'amfebutamone'. In 2000, the INN was reassigned as *bupropion* (WHO, 2000).

Bupropion is considered to be an atypical antidepressant and smoking cessation aid. Initially researched and marketed as an antidepressant, bupropion was subsequently found to be effective as a smoking cessation aid. In 2007, it was the fourth most prescribed antidepressant in the US retail market. In contrast with amphetamine and methylphenidate, there are no reported feelings of 'liking the drug' and no desire to take it again. (Rush, Kollins and Pazzaglia, 1998). A comparison of bupropion SR (150 mg) with caffeine (178 mg) indicated that caffeine may have higher abuse liability since it resulted in more reports of pleasant feelings and a 'high' than bupropion (Zernig *et al*, 2004).

Bupropion is structurally related to 2-substituted aminopropiophenone, pyrovalerone.

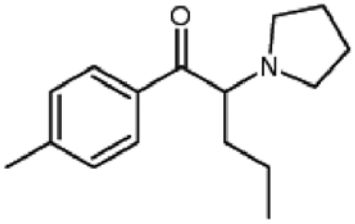
Other cathinone-based substances that have been recorded include: 3-MMC, 4-EMC, 4-MEC, N,N-DMMC, N,N-DEMC, 3,4-DMMC, Brephedrone, bk-MDA, Ethylone, bk-IMP, 4-Methylbuphedrone, Eutylone, bk-DMBDB, 2-Methylbutylone, 5-Methylbutylone.

8 INN (International Nonproprietary Names) facilitates the identification of pharmaceutical substances or active pharmaceutical ingredients. Each INN is a unique name that is globally recognised and is public property. A non-proprietary name is also known as a generic name (WHO, nd).

1.4 Pyrovalerones

Pyrovalerone

Molecular structure: 1-(4-Methylphenyl)-2-pyrrolidin-1-yl-pentan-1-one

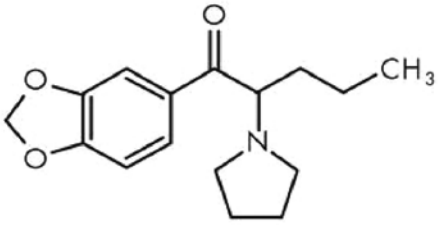


Molecular formula: $C_{16}H_{23}NO$
Molecular weight: 245 g/mol

Pyrovalerone was synthesised for the first time in 1964 by Heffe and is available under the trade names of Centroton® and Thymergix® (Meltzer, Butler, Deschamps and Madras, 2006). Pyrovalerone is used as both an appetite suppressant and for the treatment of chronic fatigue (Yohannan and Bozenko, 2010).

MDPV

Molecular structure: 3,4-Methylenedioxypyrovalerone



Molecular formula: $C_{16}H_{21}NO_3$
Molecular weight: 275 g/mol

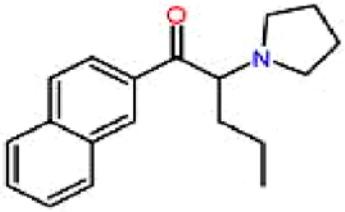
CAS #: 24622-62-6

MDPV was first synthesised in 1964 as a class of stimulant and is the methylenedioxy analogue of pyrovalerone. It occurs as a white/light tan powder that develops an odour on exposure to air. There appear to be no known studies to date on the clinical effects of MDPV, and users often describe it as boosting the libido (Yohannan and Bozenko, 2010). The pyrrolidine ring and the tertiary amino group in MDPV could lead to a more lipophilic (i.e. more potent) molecule (EMCDDA, 2010d).

1.5 Naphthylpyrovalerones

Naphyrone (Naphthylpyrovalerone)

Molecular structure: 1-naphthalen-2-yl-2-pyrrolidin-1-ylpentan-1-one



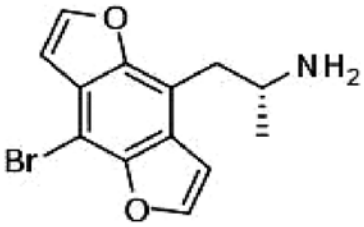
Molecular formula: $C_{19}H_{23}NO$
Molecular weight: 281 g/mol

CAS #: 850352-53-3

Naphyrone is a naphthyl analogue of the cathinones and bears a close resemblance to pyrovalerone. It is often sold as a white crystalline powder. There is very little published safety or toxicological data available on naphyrone (AMCD, 2010).

Bromo-Dragonfly

Molecular structure: 1-(8-Bromobenzo[1,2-b;4,5-b]difuran-4-yl)-2-aminopropane



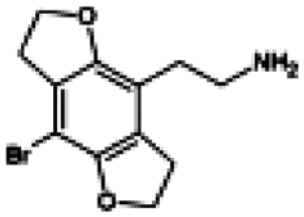
Molecular formula: $C_{13}H_{12}BrNO_2$
Molecular weight: 294 g/mol

CAS #: 502759-67-3

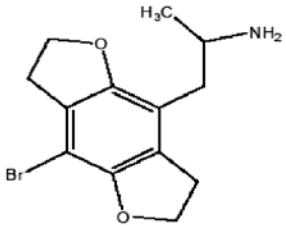
The colloquial name Bromo-Dragonfly is due to the pictorial representation of its chemical structure, which resembles a dragonfly. It is also known as 3C-Bromo-Dragonfly, DOB-Dragonfly, DragonFly and B-Fly. Early reports of its consumption appeared in 2005-2006 on the Internet; however consumption can be traced back to 2001. Structurally, Bromo-Dragonfly is similar to phenethylamines such as 2C-B (4-bromo-2,5-dimethoxyphenethylamine) and DOB (2,5-dimethoxy-4-bromoamphetamine). Bromo-Dragonfly was first synthesised in 1998 by Parker as a novel brain research chemical. It is considered a potent hallucinogen, with potency only slightly less than that of LSD. In addition, it has a long duration of action, and is reported to last up to three days (Andreasan *et al.*, 2009; Psychonaut WebMapping Research Group, 2009).

The FLY compounds (2-C-B-FLY, 3-C-B-FLY and Bromo-DragonFly) have been submitted for analysis to forensic laboratories both in liquid form and on blotter paper (US DEA, 2007). 2-C-B-FLY and 3-C-B-FLY are shown below to illustrate the structural simiarilities between them and Bromo-Dragonfly.

2-C-B-FLY



3-C-B-FLY

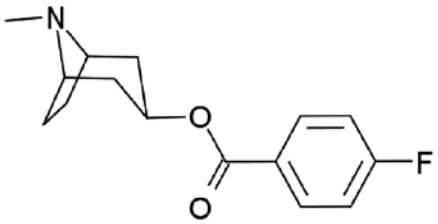


3C-B-FLY

1.6 Synthetic cocaine

Fluorotropcocaine

Molecular structure: 3-(*p*-fluorobenzyloxy)-tropane is (1*R*,5*S*)-(8-methyl-8-azabicyclo[3.2.1]octan-3-yl)-4-fluorobenzoate (3-(*p*-fluorobenzoyloxy)tropane (*p*FBT))



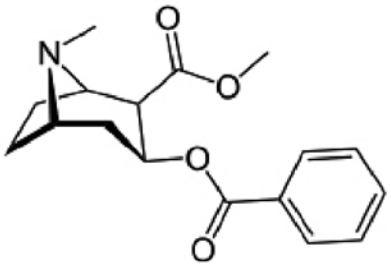
Molecular formula: $C_{15}H_{18}FNO_2$
Molecular weight: 263 g/mol

CAS #: 172883-97-5

Fluorotropacocaine is a synthetic form of cocaine. It is structurally very close to cocaine, yet differs from it in that it has a fluorine atom attached to the phenyl group, and it lacks the carboxyl group which is present on the tropane ring in cocaine. Synthesis can be achieved through the condensation of tropine with p-fluorobenzoic acid. Fluorotropacocaine is encountered as a white powder which, when snorted, demonstrates local anaesthetic activity. However, little is known about the pharmacokinetics and pharmacodynamics of this substance in the human body. The substance has no clinical use in the EU (EMCDDA, 2010c). Cocaine and tropacocaine are illustrated below to show their structural similarities.

Cocaine

Molecular structure: methyl (1*R*,2*R*,3*S*,5*S*)-3- (benzoyloxy)-8-methyl-8-azabicyclo[3.2.1] octane-2-carboxylate



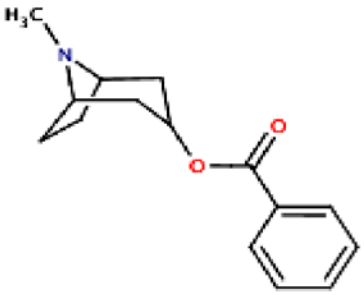
Molecular formula: $C_{17}H_{21}NO_4$
Molecular weight: 303 g/mol

Cas #: 50-36-2

Cocaine is illustrated for comparison to its synthetic counterpart, fluorotropacocaine.

Tropacocaine

Molecular structure: (8-methyl-8-azabicyclo[3.2.1]octan-3-yl) benzoate



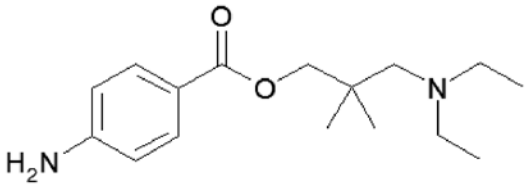
Molecular formula: $C_{15}H_{19}NO_2$
Molecular weight: 245 g/mol

CAS #: 537-26-8

Tropacocaine is an alkaloid found in coca leaves along with cocaine. The mean tropacocaine content found in an analysis of 4,000 cocaine samples was 0.02% (relative to cocaine) (Moore and Casale, 1994).

Dimethocaine

Molecular structure: (3-diethylamino-2,2-dimethylpropyl)-4-aminobenzoate



Molecular formula: $C_{16}H_{26}N_2O_2$
Molecular weight: 278 g/mol

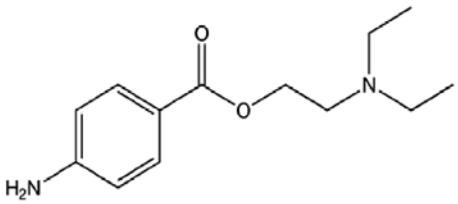
CAS #: 94-15-5

Dimethocaine is also known as Larocaine or DMC. Dimethocaine more closely resembles the local anaesthetic procaine, which is sometimes seen as an adulterant in cocaine samples. Dimethocaine lacks the tropane ring evident in the structure of cocaine. Like fluorotropacocaine, dimethocaine is encountered as a white powder that is snorted and is a synthetic compound. Synthesis would be possible through condensing 4-aminobenzoic acid ethyl ester with diethylamino-t-butanol (EMCDDA, 2010c).

The structure of procaine is illustrated below for comparison purposes.

Procaine

Molecular structure: 2-(diethylamino) ethyl 4-aminobenzoate



CAS #: 59-46-1

Molecular formula: $C_{13}H_{20}N_2O_2$
Molecular weight: 236 g/mol

1.7 Synthetic cannabinoids

Synthetic cannabinoids are considered to be functionally similar to THC (which is the active ingredient in cannabis), but are considered to be more potent (Geller, 2007). Synthetic cannabinoids are divided into seven major structural groups:

1. Naphthoylindoles (e.g. JWH-018, JWH-073, JWH-398)
2. Naphthylmethylindoles
3. Naphthoylpyrrol
4. Naphthylmethylindenes
5. Phenylacetylindoles (e.g. JWH-250)
6. Cyclohexylphenols (e.g. CP47.497 and the homologues of CP47.497 (e.g. C6, C7,C8)
7. Classical cannabinoids (e.g. HU-210)

Some of the synthetic cannabinoids listed above have been found in products such as 'Spice', 'Spice Gold', 'Spice Silver', 'Spice Diamond', 'Yucatan Fire', 'Sence', 'Smoke XXX', 'Chill X', among others. These products, sold as smoking mixtures, often contain dried herbal material that has likely to have been sprayed with a solution of a synthetic cannabinoid. Often, these products, like other new psychoactive substances products, state 'Not for human consumption' on their packaging. Many of the synthetic cannabinoids are believed to be more potent than Δ^9-THC (EMCDDA, 2009).

Other synthetic cannabinoids include:

JWH-015, JWH-081, JWH-133, JWH-200, JWH-250, JWH-398

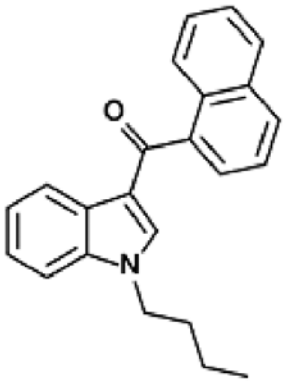
CP47,497(-C6, -C7, C8, -C9), CP55,244, CP55,940

HU-211, WIN 55,212-2, AM 694

9 See Kavanagh 2010b, 2010c, 2010e and the current review.

JWH-073

Molecular structure: 1-butyl-3-(1-naphthoyl) indole



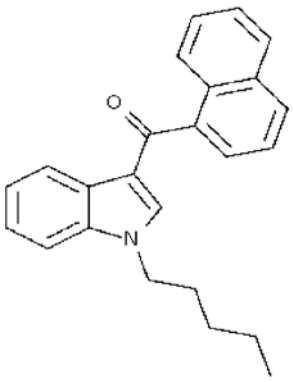
Molecular formula: $C_{23}H_{21}NO$
Molecular weight: 327 g/mol

CAS #: 208987-48-8

The abbreviation JWH stands for John W Huffman, one of the inventors of the compound. JWH-073 is a naphthoylindole (which is one of seven major structural groups within the synthetic cannabinoid class). JWH-073 is an alkyl homologue of JWH-018. JWH-073 has been recorded as a substitute for JWH-018, in essence a second generation product. (Lindigkeit *et al*., 2009).

JWH-018

Molecular structure: 1-pentyl-3-(1-naphthoyl) indole



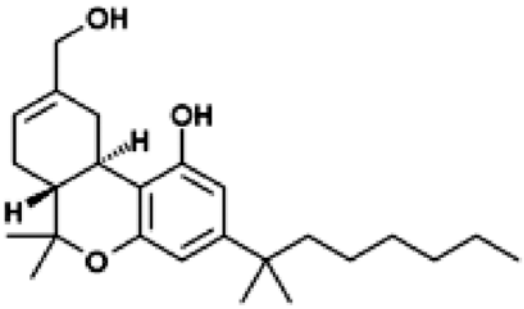
Molecular formula: $C_{24}H_{23}NO$
Molecular weight: 341 g/mol

CAS #: 209414-07-3

JWH-18, an n-pentyl homologue, was the first ever synthetic cannabinoid reported to the EWS in 2008 (EMCDDA-Europol, 2009). There are no data available on the clinical effects in humans with respect to JWH-018 (Pistos and Spiliopoulou, 2010).

HU-210

Molecular structure: (6a*R*,10a*R*)- 9-(Hydroxymethyl)- 6,6-dimethyl- 3-(2-methyloctan-2-yl)- 6a,7,10,10a-tetrahydrobenzo [c]chromen- 1-ol



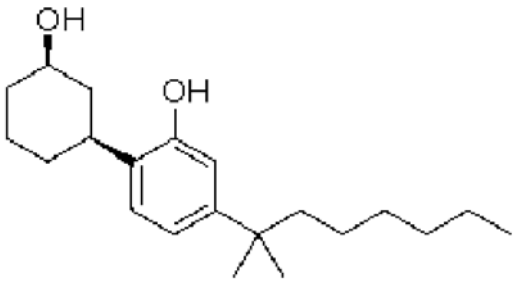
Molecular formula: $C_{25}H_{38}O_3$
Molecular weight: 387 g/mol

CAS #: 112830-95-2

HU-210 was first synthesized in 1988 by a group led by Professor Raphael Mechoulam at the Hebrew University (Mechoulam, Lander, Breuer and Zahalka, 1990). HU-210 is 100 to 800 times more potent than natural THC from cannabis , and it has an extended duration of action (Devane *et al.*, 1992). In addition, recent research has documented that HU-210 appears to have similar molecular mechanisms related to tolerance as those of Δ^9-THC (Pistos and Spiliopoulou, 2010).

CP47497

Molecular structure: 2-[(1R,3S)-3-hydroxycyclohexyl]- 5-(2-methyloctan-2-yl)phenol



Molecular formula: $C_{21}H_{34}O_2$
Molecular weight: 318 g/mol

CAS #: 70434-82-1

CP47497 was developed in the early 1980s by a group of Pfizer researchers during the development of analgesics based on (-)-9-nor9ß-hydroxyhexahydrocannabinol (HHC). In addition to CP47,497, CP55,940 was also developed, and both were found to be more potent than Δ^9-THC *in vivo* (Ottani and Giuliani, 2001).

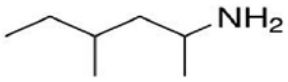
9 See Kavanagh 2010b, 2010c, 2010e and the current review.

1.8 Newly emerging psychoactive substances

The compounds dimethylamylamine (DMAA) and desoxypipradrol were identified in head shop products purchased in Ireland following the May 2011 Order[9].

Dimethylamylamine (DMAA)

Molecular structure: 4-methylhexan-2-amine



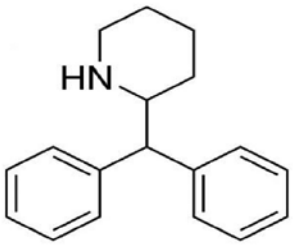
Molecular formula: $C_7H_{17}N$
Molecular weight: 115 g/mol

CAS #: 105-41-9

Dimethylamylamine is also known as methylhexaneamine and has been marketed as Forthan, Forthane, Floradrene and Geranamine. Dimethlamylamine was patented by Eli Lilly as a nasal decongestant. It is derived from the geranium plant and is sometimes labelled as geranium oil. The Geranamine trademark is owned by Proviant Technologies. In 2010 methylhexaneamine was placed on the WADA (World Anti-Doping Agency) Prohibited List and is classed as a Non-Specified Stimulant. Dimethylamylamine is a synthetic substance that has been found to be one of the main ingredients in the new range of 'BZP – free party pills' (Gee, Jackson and Easton, 2010).

Desoxypipradrol

Molecular structure: 2-diphenylmethylpiperidine



Molecular formula: $C_{18}H_{21}N$
Molecular weight: 251 g/mol

Cas #: 519-74-4

Desoxypipradrol is structurally related to methylphenidate and pipradrol, with desoxypipradrol having the longest half-life. It was developed by the pharmaceutical company CIBA, now known as Novartis, in the 1950s. It was investigated for the treatment of narcolepsy and ADHD (Bellucci, 1955).

The following new psychoactive substances were reported to the EMCDDA and Europol for the first time in 2009.

9 See Kavanagh 2010b, 2010c, 2010e and the current review.

Pyrrolidinophenone derivatives:

PPP

(α-pyrrolidinopropiophenone) – 27 January 2009 – Denmark; and 2 February 2009 –Finland

MDPPP

(3',4'-methylenedioxy-α-pyrrolidinopropiophenone) – 12 November 2009 – Denmark

Tryptamine compounds:

4-AcO-MET

(4-acetoxy-N-methyl-N-ethyltryptamine) – 24 April 2009 – Finland

4-AcO-DMT

(4-acetoxy-N,N-dimethyltryptamine) – 17 August 2009 – Finland

Phenethylamines:

2-PEA

(2-phenethylamine) – 2 October 2009 – Finland

Trimethoxy derivative:

TMA-6

(2,4,6-trimethoxyamphetamine) – 3 June 2009 – Denmark

Fluoro containing amphetamine-type compounds:

2- or 3-fluoroamphetamine – 8 January 2009 – Belgium

3-FMA

(3-fluoromethamphetamine) – 17 November 2009 – Finland

4-MA

(4-methylamphetamine) – 14 December 2009 – Belgium

Cathinones:

bk-PMMA/methedrone

(4-Methoxymethcathinone) – 12 October 2009 – Sweden

Metamfepramone

(N,N-dimethylcathinone) – 12 November 2009 – Denmark

Others:

2-DPMP

(2-diphenylmethylpiperidine) – 2 February 2009 – Finland

ODT

(o-desmethyltramadol) – 26 June 2009 – Germany

Etaqualone

(3-(2-ethylphenyl)-2-methyl-quinazolin-4-one): – 12 November 2009 – Denmark

Pregabalin

((S)-3-(aminomethyl)-5-methylhexanoic acid) – 16 December 2009 – Finland

The browsing of drugs-related forums such as *www.drugs-forum.com* led to the identification of the following substances of interest to users of new psychoactive substances:

1. 5-iodo-2-aminoindane, 2-aminoindane and 5,6-Methylenedioxy-2-aminoindane
2. NBOMe-2Cs
3. 4-OH-AET
4. MMDA-2
5. 2-C-X-ETOs
6. Escaline
7. Proscaline
8. Jimscaline
9. 2c-e
10. 4acO-dmt
11. NBOMe –'family'
12. AAI-derived cannabinoids
13. Amthetamine
14. Methamthetamine (thiophene-analogues of plain (meth) amphetamines)
15. BTCP
16. Synthacaine
17. Benzo Fury

1.9 Synthetic drugs of abuse in the future

A synthetic drug was initially described as one which was designed by a clandestine chemist to produce a certain pharmacological response (Henderson, 1986). Terms such as *designer drugs* have been used to describe clandestinely produced drugs which have both structural and pharmacological similarities to a controlled substance. However, these substances in themselves are not controlled (Langston and Rosner, 1986). The US Drug Enforcement Agency felt that the term *designer drug* lent an element of glamour to the subject and, for that reason, it suggested the use of an alternative term: a *controlled substance analog* (CsA) (Cooper, 1988).

In attempting to predict which substances will become the synthetic drugs of recreational use and abuse of the future, this raises the issue of the possibility of 'self-fulfilling prophecy', as noted by (Shulgin, 1975, p 1). Shulgin's work provides a useful resource for those who are attempting to predict next generation drugs of abuse, or are attempting to identify certain trends. The Internet also provides access to voluminous sound scientific information which is readily available in the public domain. This seems to be the route that many have taken in the development of new psychoactive substances to date.

Predictions of future drugs of abuse have not always been accurate. The case of synthetic cannabinoids such as 'Spice' is illustrative. The emergence of synthetic cannabinoids on the drug scene was considered unlikely due to the availability of marijuana in the market (Cooper, 1988). Shulgin considered their appearance unlikely due to 'the economics inherent in their production' (Shulgin, 1975, p 18).

Shulgin (1975) highlighted three chemical groups which met the requirements of 'hallucinogenic drugs that are most likely candidates for modification resulting in future drugs with abuse potential'. The three groups were indoles, related to tryptamines and carbolines, phenethylamines and choline analogues, related to atropine. These groups met the requirements of being totally synthetic or if plant sources, were simple enough to allow the synthesis of analogues.

Regarding the indoles, Shulgin stated that the α-methyl analogs of 5-methoxytryptamine had been uninvestigated, and thus demonstrated a potential avenue of research. Shulgin (1975) highlighted that in the case of the phenethylamine group, certain structural changes could give rise to an amplification of the potency of the resulting hallucinogen. One example includes increasing the alkyl chain length to three carbons, and 'then reorientation of the methoxyl substitutions and appropriate changes in the substitution patterns'. Cooper (1988) also highlighted the indole group. As of 1972, approximately 500 naturally occurring indole alkaloids were documented; by 1980 this number had increased to approximately 1,200.

Regarding the phenethylamines, Cooper (1988) noted that using methylenedioxy in the place of two adjacent ring-substituted methoxy groups with carbon-3,4 substituents gave rise to much greater potency. He suggested the potential of such substances, including synephrine or phentermine, to be used as CsA models. In addition, it was speculated that there were possibly 752 'possible hallucinogenic CsAs' to be developed that are structurally related to dopamine.

Shulgin (1975) proposed substances such as phentermine and diethylpropion as possible drugs of misuse in the future, and he highlighted compounds based on the structure of pipradrol (diphenyl-2-piperadylcarbinol). As was found during the course of this review, synthetic forms of cocaine have made an appearance on the market, and one such compund (fluorotropacocaine) was identified in a product through analyses undertaken for this review. Shulgin (1975) drew attention to the possibility of synthetic forms of cocaine, stating that 'it seems reasonable to anticipate that as more synthetic attention is directed towards this family of stimulants, more easily prepared analogs will be seriously investigated as cocaine substitutes'. Cooper (1998) also mentioned the potential of modifications to the cocaine molecule, stating that 'certain modifications of natural cocaine can result in products having substantially greater potencies than cocaine'. This would appear to be a lucrative avenue for clandestine chemists given that, for example, 1kg of cocaine could then yield a product with a potency up to 60 times greater.

King (2009), speaking of Shulgin's work, stated that it was 'difficult to overestimate the importance of the book *PIHKAL* in generating interest in synthetic drugs' (King, 2009, p 94). *PIHKAL (Phenethylamines I Have Known and Loved)* was written in 1991 and has sold in the region of 40,000 copies. The production of illicit phenethylamines post-1991 is thought to have increased dramatically. Shulgin's follow-up book *TIHKAL (Tryptamines I Have Known and Loved)* sold fewer copies and appeared to have less of an impact.

Phenethylamines were a rich source for the development of synthetic drugs and were investigated intensely. Attention now seems to have turned to other new drug families, for example, substituted piperazines and cathinones. King (2009) identified the interest shown in structures that exhibit 'an aromatic ring (usually phenyl) bearing a side chain with an amino group, which may be primary, secondary or tertiary'. He indicated the observation of two new phenethylamines (ring-substituted) that were not described in *PIHKAL*, Bromodragonfly (1-(8-bromobenzol[1,2-b;4,5-b"] difuran-4-yl-2-aminopropane) and 2C-B-Fly (1-(8-bromo-2,3,6,7-tetrahydrobenzo[1,2-b;4,5-b"]difuran-4-yl)-2-aminoethane). The colloquial terms for these substances arise from the pictorial representations of their chemical structures.

In the case of cathinones, the US Drug Enforcement Administration (DEA) predicted the clandestine manufacture of ring-substituted cathinones as far back as 1997 (Dal Cason, 1997).

1.10 The role of the Internet

The Internet plays an important role in the marketing, distribution and development of new psychoactive substances. This point is illustrated by the case of the product 'Spice'. Unlike cocaine or ecstasy, 'Spice' was marketed and available only via the Internet or in specialised shops (head shops), rather than through illegal/clandestine distribution. As a result, trading of this drug went largely undetected and, for some time, it avoided the attention of law enforcement agencies due to the lack of seizures that might otherwise indicate criminal activity (EMCDDA, 2009).

The Internet by its nature offers numerous advantages for suppliers of these products. It provides access to an infinitely vast pool of customers; it does not require a large investment from suppliers who can establish their operations swiftly and easily; the market is open continuously; suppliers are afforded a relative level of anonymity when operating from a website – something which would be less achievable if these operators were using a standard business model. The Internet offers ease and rapidity of access to the drug market. In addition, those supplying drugs via the Internet can potentially overcome the laws of different countries, thus making enforcement or legal action in response to their activities very difficult. For consumers of the products, the Internet offers flexibility to purchase from different locations, such as home, work, school or college. A vast amount of information on substances is available online, although this may be unreliable, misleading and hard to discern for the general Internet user.

An apparent flaw with initiatives such as the EMCDDA's Early Warning System is that its information is generated from seizures captured at street level. It does not, unfortunately, take into consideration information accessed from so-called 'virtual' markets (i.e. Internet websites). The 2002 Psychonaut Project Final Report identifies 165 websites which offer the sale of drug-related items. This included paraphernalia and/or illicit/licit psychoactive substances. In addition, it documented 148 websites that provided details in the synthesis and/or extraction of licit/illicit psychoactive compounds from a range of products. This included, for example, how to extract lysergic acid amide from the seeds of morning glory plants. In 2002 alone, the Psychonaut Project identified 92 'novel' psychoactive substances from its online research. It should be noted that none of these 92 substances generated reports of misuse in Medline. The project also highlighted that the combination of the Internet and drugs has thus far been mostly exploited by those who demonstrate a private personal/group interest in this area (The Psychonaut 2002 Project, Final Report, 2002).

As part of the current review, the Google Trends tool was utilised to gain insight into trends in search terms relating to new psychoactive substances. Two keywords were searched: 'legal high' and 'mephedrone'. The Google Trends output in Table 1.2 covers 'all years' data (with trends increasing from 2006-2010, in line with the increase in new psychoactive substances).

The term 'legal high' yielded the following trends information:

Table 1.2: Google trends information on the search term 'legal high'

Rank	Regions	Top searches worldwide	Top searches Ireland
1	**Ireland**	Legal high	Legal highs Ireland
2	UK	Legal highs to buy	Legal high
3	New Zealand	Herbal highs	Head shop
4	Australia	Legal drugs	Herbal highs
5	US	Legal herbal highs	Head shops
6	Canada	UK legal highs	–
7	Germany	Legal highs drugs	–

In addition, Google Trends highlighted Dublin as the top city in Ireland to search the keyword 'legal high'. For the keyword 'legal high', the biggest peak was observed in Ireland in late 2009 and into 2010.

The search term 'mephedrone' yielded the following trends information:

Table 1.3: Google trends information on the search term 'mephedrone'

Rank	Regions	Top searches worldwide	Top searches Ireland
1	UK	Buy mephedrone	Buy mephedrone
2	**Ireland**	Mephedrone effects	Mephedrone Ireland
3	Sweden	Mephedrone UK	–
4	Hungary	Methadrone	–
5	Australia	Meow	–
6	New Zealand	Meow meow	–
7	Netherlands	Mephedrone online	–
8	Austria	Mephedrone plant feeder	–
9	Finland	Methylone	–
10	Romania	Plant food	–

1.11 Analysis of new psychoactive substances

A range of new psychoactive substances was obtained from Irish head shops and online. Findings from the analyses of these products are presented below.

1.12 Method of analysis

The analysis was carried out using the TICTAC database and gas chromatography mass spectrometry.

1.12.1 TICTAC

TICTAC Pro: July, 2010 Version 15.3, is a comprehensive database for the visual identification of drugs (primarily tablets and capsules) and substances that may resemble drugs. The database is a CD-ROM, which contains over 65,000 colour photographs and both detailed and current information on thousands of products. The database contains comprehensive data on illicit products, branded and generic products, herbal products, veterinary products and confectionary that might be confused with drugs. In total, the database contains information on 24,478 products, 3,630 drugs, 1,081 companies, over 65,000 photographs, 109 drug monographs and over 4,146 slang terms.

1.12.2. Gas chromatography mass spectrometry (GC-MS)

GC-MS is a hyphenated analytical technique which was developed in the 1950s. The two techniques are combined to allow an analytical chemist to qualitatively and quantitatively analyse a solution containing a number of chemicals. This hyphenated technique allows for a more accurate degree of substance identification than would be possible from either system if they were used separately. The technique enables the separation of mixtures of chemicals into individual components. Once they are isolated, the components can then be identified and quantified individually. GC-MS is a technique used in pharmaceutical, medical, environmental and forensic fields.

Gas chromatographic mass spectrometry is the single most important tool for the identification and quantitation of volatile and semi-volatile organic compounds in complex mixtures. As such, it is very useful for the determination of molecular weights and (sometimes) the elemental compositions of unknown organic compounds in complex mixtures. The advantages of this instrument is that it is relatively inexpensive, simple to control by a computer, provides rapid analysis, and achieves good resolution and repeatability.

GC-MS conditions:
GC-MS analysis was performed using a Varian Star 3400 GC with a Saturn 2000 MS.

Column: DB5MS 30m x 0.25 mm x 0.25 µ (film thickness).

Injector: 250°C

Temperature programme: Initial temperature of 70°C (for four minutes) ramped up to 300o C at a rate of 10°C/min.

Transfer line: 280°C

Solvent delay: four minutes

Mass spectrometer: 40-450 Dalton (atomic mass units)

Total run time: 27 minutes

1.12.3 Reference standards

The results of the analysis can only be considered to *indicate* the presence of a substance due to the fact that no reference standards were available[10]. A licence to legally possess a number of the reference standards under the Irish Medicines Board Act 1995 was applied for; however the licence was not issued in time for analysis.

The results are based on matches achieved through mass spectra libraries and mass spectra sourced from other agencies. For this reason, the results considered in this report will be addressed in such a manner that analysis *'indicated the presence of'*. In order to obtain a legally defensible identification, it would be necessary to analyse an authentic reference sample under the same conditions as the product.

1.12.4 Other analyses

The following analyses were also performed:

1. A visual examination product packaging
2. An examination of product ingredients (as listed on the packaging)
3. A review of a range of new psychoactive substances available, based on information from 25 popular websites selling new psychoactive substances, and current analysis on new psychoactive substances obtained from various sources (see Appendix A).
   a) Powders
   b) Capsules/tablets
   c) Smoking blends

1.13 Products

In total, 42 head shop products sourced after the May 2010 Order were analysed. In addition, results have been included from seven head shop products that were analysed before the May 2010 Order. These products were obtained between January and April 2010.

Details of the sample type, date of purchase and location of purchase are given for the samples obtained by An Garda Síochána. Tables 1.4–1.7 give details of the tablet, capsule, powder and herbal samples obtained. Of the 23 products obtained from An Garda Síochána, 43% were tablet samples, 26% were capsule samples, 26% were powder samples and 4% were herbal samples.

10 Reference standards are not available for many new psychoactive substances. Reference standards are discussed further in Section 5.

Table 1.4 Tablet samples provided by An Garda Síochána

Product	Date	Location	Packaging states 'Not for human consumption'
5-HTP	10/06/2010	*Higher State*, Duke Street, Athy, Co Kildare	No
'Blessed'	12/06/2010	*Downtime*, Castle Street, Castlebar, Co Mayo	No
'Charged'	10/06/2010	*Galway Head Store*, Galway	No
'Diablo'	14/06/2010	*Funky Skunk*, Bantry, Co Cork.	No
'Exotic PH1'	10/06/2010	*Galway Head Store*, Galway	No
'Exotic PH1A'	10/06/2010	*Euphoria*, Connaught Street, Athlone	No
'Exotic PR1'	10/06/2010	*Nirvana*, 30 Main Street, Portlaoise	No
'Exotic SM1'	10/06/2010	*First Light Headshop*, Galway	No
'Infernal'	14/06/2010	*Ectea*, Old Market Place, Bandon, Co Cork	No
'Storm'	10/06/2010	*Higher State*, Duke Street, Athy, Co Kildare	No

Table 1.5 Capsule samples provided by An Garda Síochána

Product	Date	Location	Packaging states 'Not for human consumption'
'BluE'	12/06/2010	*House of Trinkets*, O'Connell Street, Waterford	Yes *
'Embrace'	10/06/2010	*Galway Head Store*, Galway	No
'Empathy'	14/06/2010	*Funky Skunk*, Bantry, Co Cork.	No
'NRG Now'	12/06/2010	*Rosies Remedies*, Ballina, Co Mayo	No
'Orbit'	09/06/2010	*Grow Out*, Malahide, Co Dubin	No
'Party On'	12/06/2010	*Rosies Remedies*, Ballina, Co Mayo	No

** The 'BluE' packaging stated 'Do not swallow'. This has thus been included in the figures for products that were covered under the 'Not for human consumption' heading.*

Table 1.6 Powder samples provided by An Garda Síochána

Product	Date	Location	Packaging states 'not for human consumption'
'Blowout'	09/06/2010	*Grow Out*, Malahide, Co Dubin	No
'Rush'	12/06/2010	*Synergy*, Killia Road, Ballina, Co Mayo	Yes
'SnowBlow'	10/06/2010	*Galway Head Store*, Galway	No
'Whack'	09/06/2010	*Hemptations*, North Circular Road, Dublin 7	No
'White Columbia'	10/06/2010	*Head Candy*, Finglas, Dublin 11	Yes
'Wildcat'	10/06/2010	*Nirvana*, Galway	Yes

Table 1.7 Herbal samples provided by An Garda Síochána

Product	Date	Location	Packaging states 'not for human consumption'
Sachet of green herbal material	09/06/2010	*Head Candy*, Dun Laoghaire, Co Dublin	No

Of the remaining 19 products tested, 14 were purchased in head shops, sex shops, and one pub (vending machine in the men's toilets), and five were purchased online by the researchers. Tables 1.8–1.10 below give the details for the tablet, capsule and powder products respectively purchased by the DIT research team in Irish head shops. The information includes the date and the exact location of purchase, and confirms whether products contain a label stating 'Not for human consumption'.

Table 1.8 Tablet samples purchased by the DIT research team

Product	Date	Location	Packaging states 'Not for human consumption'
'Bio-Happiness'	09/08/2010	*Dublin Head Shop*, Temple Bar, Dublin 2	No
'Fuel'	09/08/2010	*Dublin Head Shop*, Temple Bar, Dublin 2	No
'Iced Diamonds'	14/06/2010	*Dublin Head Shop*, Temple Bar, Dublin 2	No

Table 1.9 Capsule samples purchased by the DIT research team

Product	Date	Location	Packaging states 'Not for human consumption'
'Golden Root'	14/06/2010	*The Long Haul (pub)*, George's Street, Dublin 2	No
'Magic'	11/08/2010	*The Wak Store*, Amiens Street, Dublin 1	Yes
'Vegas Nights'	09/08/2010	*Nirvana*, 60A William Street, South, Dublin 2	No

Table 1.10 Powder samples purchased by the DIT research team

Product	Date	Location	Packaging states 'Not for human consumption'
'100% Pure'	09/08/2010	*The Buzz Stop*, Thomas Street, Dublin 8	Yes
'Duffy's Hysteria'	09/08/2010	*Dublin Head Shop*, Temple Bar, Dublin 2	Yes
'Enchanted (NS)'	11/08/2010	*The Wak Store*, Amiens Street, Dublin 2	No
'Enchanted (SS)'	09/08/2010	*The Buzz Stop*, Thomas Street, Dublin 8	No
'Platinum'	09/08/2010	*Dublin Head Shop*, Temple Bar 2	Yes
'Pure NRG'	09/08/2010	*Dublin Head Shop*, Temple Bar, Dublin 2	Yes
'Stardust Extreme'	09/08/2010	*Nirvana*, 60A South William Street, Dublin 2	Yes
'White Fizz'	09/08/2010	*Nirvana*, 60A South William Street, Dublin 2	Yes

The remaining five products tested were purchased online. In total, ten products were purchased online from four different websites. All four websites delivered the products purchased. However, two of the companies delivered their products outside the time frame for analysis. Tables 1.11–1.12 below detail the online products tested, the date they were ordered, the web address, and also the online products that were delivered outside the time frame for analysis.

Table 1.11 Online products tested

Product	Sample type	Date	Web address	Packaging states 'Not for human consumption'
'Cristalius'	Powder	22/07/2010	*www.weedwholesale.com*	Yes
'E=XTC'	Tablets	21/07/2010	*www.mysteriousplants.com*	Yes
'Ivory Wave'	Powder	21/07/2010	*www.mysteriousplants.com*	Yes
'Mind Candy'	Tablets	21/07/2010	*www.mysteriousplants.com*	Yes
'Plan B'	Powder	21/07/2010	*www.mysteriousplants.com*	Yes

Table 1.12 Online products ordered and delivered outside of analysis time frame

Product	Sample Type	Date	Web Address
'Fairy Dust'	Powder	27/07/2010	*www.herbalaromas.co.uk*
'Ocean Snow Ultra'	Powder	27/07/2010	*www.am-hi-co.com*
'Recharge Extra'	Powder	27/07/2010	*www.am-hi-co.com*
'Red Doves'	Tablets	27/07/2010	*www.am-hi-co.com*
'Shake and Vac'	Powder	27/07/2010	*www.herbalaromas.co.uk*

Included in the summary list of results are products tested prior to the May 2010 Order. These were purchased in January and April 2010. Most of the products were powders. Table 1.11 details those tested, the month in which they were tested, and where they were sourced.

Table 1.13 Products tested prior to the May 2010 Order

Product	Sample type	Date	Location	Packaging states 'Not for human consumption'
'Blow'	Powder	January 2010	Head shop	Yes
'Magic'	Powder	January 2010	Head shop	Yes
'Mephedrone'	Powder	January 2010	Online	Yes
'Snow'	Powder	January 2010	Head shop	Yes
'Wildcat'	Powder	April 2010	Head shop	Yes
'Doves'	Tablets	January 2010	Head shop	Yes
'Smoke XXX'	Herbal material	January 2010	Head shop	Yes

1.14 Product packaging

Unlike products that are produced and sold in a regulated environment, new psychoactive substance products do not routinely list information such as ingredients, health warnings, dosage information, expiry dates, or contact details of manufacturers. Little is known about the toxicity of these products and the substances they contain, and therefore suppliers cannot claim to correctly advise consumers as to the dosage amounts, the health risks or the dangers associated with consuming such products. Table 1.14 below details the breakdown of the details supplied on the packaging of 49 products tested. Table 1.15 highlights the types of products where no information was listed on the packaging.

Table 1.14 Percentage of products (tablets, powders, capsules and herbal material) analysed that contained information on packaging (n=49)

Type of information provided on packaging	Percentage of total products containing this information
Ingredients	61
Health warnings	39
Dosage information	41
Expiry date	29
Contact details of manufacturer	41
'Not for human consumption'	47

Table 1.15 Breakdown of the types of products that listed no information on the packaging

No Information	Powders	Tablets/ Capsules	Herbal
Ingredients (out of 19 samples)	15 (79%)	2 (11%)	2 (11%)
Health warnings (out of 30 samples)	20 (67%)	8 (27%)	2 (7%)
Dosage information (out of 29 samples)	22 (76%)	5 (17%)	2 (7%)
Expiry date (out of 35 samples)	20 (57%)	13 (37%)	2 (6%)
Contact details of manufacturer (out of 29 samples)	19 (66%)	8 (28%)	2 (7%)

1.15 Purported product ingredients

The products examined varied greatly in terms of ingredients information provided. The table below shows the full range of ingredients listed on the product packaging; it also shows the corresponding products which claimed to contain these ingredients. The names of the ingredients printed on the packaging were recorded in the table below exactly as they appeared; spelling mistakes have not been corrected. This issue of inadequate information or inaccurate information serves to highlight a lack of quality control and possible lack of knowledge on the part of the producer.

A significant number (75%) of the tablet products obtained and analysed provided information on the packaging, and listed the ingredients. In comparison, 67% of the capsule products listed the ingredients, and only 13% of the powder samples listed the ingredients. Tables 1.16–1.18 list each of the categories of products, as well as the individual products that had ingredients listed on the packaging. No herbal products listed ingredients.

Table 1.16 Tablet products and ingredients listed on the packaging. (Ingredients recorded and written exactly as stated on the packaging)

Product/tablets	Listed ingredients
'5-HTP'	Dibasic Calcium Phosphate, Griffonia Seed Extract, Microcrystalline Cellulose
'Bio-Happiness'	Astralgus Root Extract, Geranium Oil/Geranium Extract , Ginseng Extract, Green Tea Leaf/Green Tea Extract, Licorice Root Extract, L-Tyrosine, Shizandra Berry Extract
'Blessed'	Anhydrous Caffeine, Citrus Aurantium, Pelargonium Graveolens, Polygonum Multiflorum, Salvia Sclarea, Theobroma Cocao
'Charged'	Anhydrous Caffeine, Citrus Aurantium, Cocao, Green Tea Leaf/Green Tea Extract, Guarana/Guarana Seed, Pelargonium Graveolens
'Diablo'	Anhydrous Caffeine, Citrus Aurantium, Clary Sage, Guarana/Guarana Seed, Pelargonium Graveolens, Polygonum Multiflorum, Theobroma Cocao, Zingiber Officinale (Ginger)
'E=XTC'	Dicalcium Phosphate, Ketones, Magnesium Stearate
'Exotic'	Anhydrous Caffeine, Citrus Aurantium, Hordeum Vulgare, Pelargonium Graveolens, Salvia Sclarea Theobroma Cocao, Vitamin C/Ascorbic Acid
'Fuel'	Anhydrous Caffeine, Citrus Aurantium, Griffonia Simplicifolia, Hordeum Vulgare, Pelargonium Graveolens, Piper Nigrum, Salix Alba, Salvia Sclarea , Theobroma Cocao, Vitamin C/Ascorbic Acid
'Iced Diamonds'	Anhydrous Caffeine, Citrus Aurantium, Hordeum Vulgare, Pelargonium Graveolens, Piper Nigrum, Salix Alba, Salvia Sclarea, Theobroma Cocao, Vitamin C/Ascorbic Acid
'Infernal'	Anhydrous Caffeine, Citrus Aurantium, Pelargonium Graveolens, Piper Nigrum, Salix Alba
'Mind Candy'	Dicalcium Phosphate, Ketones*, Magnesium Stearate
'Storm'	Anhydrous Caffeine, Citrus Aurantium, Hordeum Vulgare, Pelargonium Graveolens, Piper Nigrum, Theobroma Cocao, Vitamin C/Ascorbic Acid

** Ketones could possibly indicate the presence of cathinones.*

Table 1.17 Capsule products and their stated ingredients

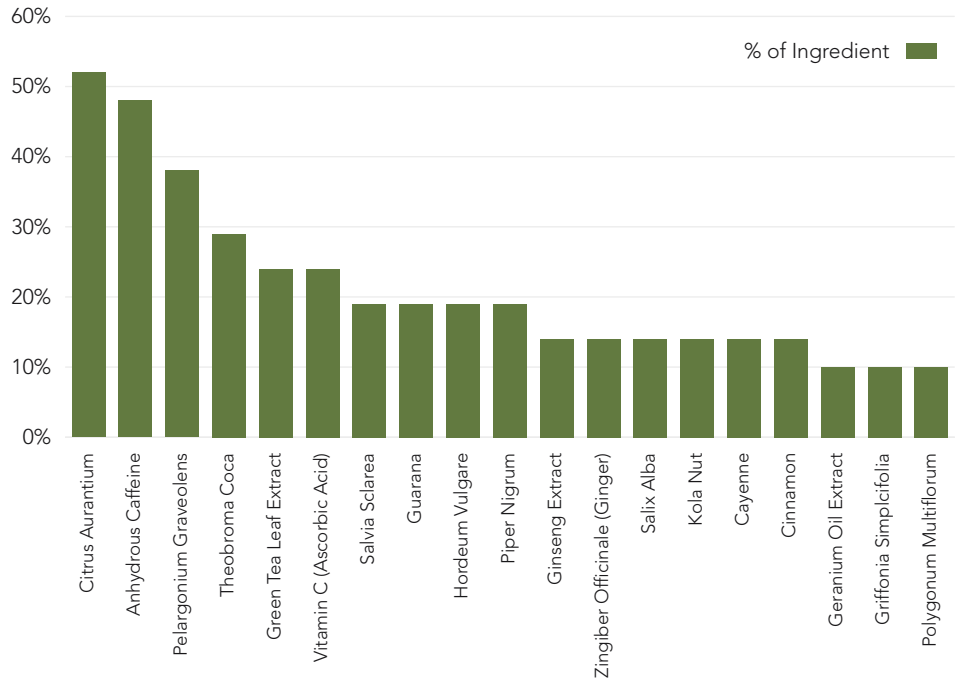
Product/capsules	Listed ingredients
'Embrace'	Geranium Oil/Geranium Extract, Green Tea Leaf/Green Tea Extract, Kola Nut Extract
'Golden Root'	Cayenne, Cynomorium Songaricum , Grape Seed Extract , Guarana/Guarana Seed, Kwaopet, Leuzea Carthamoides, Muira Pauma, Rhodiola Rosea, Schisandra Chinensis (Extract), Siberian Ginseng Extract, Tongkat Ali
'NRG Now'	Cayenne, Cinnamon, Citrus Aurantium , Green Tea Leaf/Green Tea Extract , Guarana/Guarana Seed, Kola Nut Extract, Korean Ginseng, Siberian Ginseng Extract, Yerba Mate, Zingiber Officinale (Ginger) powder
'Orbit'	Citrus Aurantium, Cocao,Gordonii, Hoodia, Octapamine
'Party On'	Cayenne, Cinnamon, Citrus Aurantium , Green Tea Leaf/Green Tea Extract , Guarana/Guarana Seed, Kola Nut Extract, Korean Ginseng, Siberian Ginseng Extract, Yerba Mate, Zingiber Officinale (Ginger) powder
'Vegas Nights'	Anhydrous Caffeine , Calcium Ascorbate, Griffonia Seed Extract, Magnesium Aspartate, Sodium Chloride

Table 1.18 Powder products and their stated ingredients

Product/powders	Listed ingredients
'Cristalius'	Hoodia, Magnesium, Sodium Sesquicarbonate, Vitamin B6, Vitamin C/Ascorbic Acid
'Ivory Wave'	Epsom Salts, Sodium Chloride
'Plan B'	Anhydrous Caffeine, Magnesium

The most frequently listed ingredients in the products which did list ingredients (21 products) are displayed in Figure 1 below.

Figure 1: % of listed ingredients in 21 Products



1.16 Review of the range of 'legal highs' tested

A review of the range of new psychoactive substances available online and in Irish head shops was performed. The range included powders, tablets/capsules and smoking blends. In addition to the list of new psychoactive substances, the corresponding psychoactive ingredients are listed, where available from alternative sources. These sources include TICTAC (2010) and the Forensic Science Laboratory (FSL, Garda Headquarters, Phoenix Park, Dublin, 2010). Findings have also been included from the analyses undertaken by Kavanagh and colleagues (2010b, 2010c, 2010d, 2010f). Results are listed in Appendix A of the review.

1.17 Results of products analysed

Tables 1.19–1.22 summarise the results of the analysis of 42 products tested after the May 2010 Order. The results are tabulated under product type.

Table 1.19 Summary table of results of tablet products analysed

Product name	Psychoactive ingredient (PI)	PI listed in ingredients?	Packaging stated 'Not for human consumption'
'5-HTP'	Several uncharacterised substances	n/a*	No
'Bio-Happiness'	Caffeine	Yes	No
'Blessed'	Caffeine One uncharacterised substance	Yes n/a	No
'Charged'	Caffeine	Yes	No
'Diablo'	Caffeine	Yes	No
'E=XTC'	TFMPP	No	Yes
'Exotic PH1'	Caffeine, Hordenine One uncharacterised substance	Yes Yes** n/a	No
'Exotic PH1A'	Caffeine Hordenine One uncharacterised substance	Yes Yes** n/a	No
'Exotic PR1'	Caffeine Hordenine One uncharacterised substance	Yes Yes** No	No
Exotic SM1	Caffeine Hordenine One uncharacterised substance	Yes Yes** n/a	No

Table 1.19 Summary table of results of tablet products analysed (continued)

Product Name	Psychoactive ingredient (PI)	PI listed in ingredients?	Packaging stated 'Not for human consumption'
'Fuel'	Caffeine Hordenine One uncharacterised substance	Yes Yes** n/a	No
'Iced Diamonds'	Caffeine One uncharacterised substance	Yes n/a	No
'Infernal'	Caffeine	Yes	No
'Mind Candy'	TFMPP***	No	Yes
'Storm'	Caffeine Hordenine One uncharacterised peak	Yes Yes** n/a	No

** n/a (Not applicable as result for product was not confirmed); ** Hordenine is a component of germinating barley (found in the roots) and this was listed in the ingredients (Mann, Steinhart and Mudd, 1963); *** TFMPP: 1-(3-trifluoromethylphenyl) piperazine.*

Table 1.20 Summary table of results of capsule products analysed

Product Name	Psychoactive ingredient (PI)	PI listed in ingredients?	Packaging stated 'Not for human consumption'
'BluE'	Dimethylcathinone Caffeine	n/a*	Yes**
'Embrace'	DMAA*** Caffeine	Yes**** Yes	No
'Empathy'	DMAA Caffeine	n/a	No
'Golden Root'	Several uncharacterised peaks	n/a*****	No
'Magic'	Benzocaine Caffeine	n/a	Yes
'NRG Now'	Caffeine	No	No
'Orbit'	DMAA Caffeine Hordenine Theobromine	No No Yes Yes	No
'Party On'	Caffeine One uncharacterised substance	No n/a	No
'Vegas Nights'	Caffeine	Yes	No

** n/a (Not applicable as no ingredients listed); ** The BluE packaging stated 'Do not swallow'. This has been included in the figures for products that were covered under the 'Not for human consumption'; ***DMAA: Dimethylamylamine; ****DMAA is found in Geranium Oil, which was listed in the ingredients; *****n/a (Not applicable as no confirmed results from analysis).*

Table 1.21 Summary table of results of powder products analysed

Product name	Psychoactive ingredient (PI)	PI listed in ingredients?	Packaging stated 'Not for human consumption'
'100% Pure'	Dimethylcathinone Caffeine	n/a*	Yes
'Blowout'	Caffeine	n/a	No
'Cristalius'	Mephedrone	n/a	Yes
'Duffy's Hysteria'	Naphyrone Caffeine	n/a	Yes
'Enchanted (NS)'	Naphyrone	n/a	No
'Enchanted (SS)'	Naphyrone	n/a	No
'Ivory Wave'	MDPV** Lignocaine	n/a	Yes
'Plan B'	Mephedrone	No***	Yes
'Platinum'	Naphyrone	n/a	Yes
'Pure NRG'	Naphyrone	n/a	Yes
'Rush'	MDPV**	n/a	Yes
'Snow Blow'	Caffeine	n/a	No
'Stardust Extreme'	Caffeine	n/a	Yes
'Whack'	Fluorotropacocaine Desoxypipradol	n/a	No
'White Columbia'[1]	Two uncharacterised substances	n/a	Yes
'White Fizz'[1]	Caffeine Several uncharacterised substances	n/a	Yes
'Wildcat'	MDPV**	n/a	Yes

** n/a (Not applicable as either no ingredients listed or no confirmed results from analysis); ** MDPV: Methylenedioxypyrovalerone; *** No (Listed caffeine in the ingredients, but caffeine was not found in the analysis).*

[1] *'White Columbia' and 'White Fizz' were analysed by Kavanagh (2010b, 2010c, 2010d, 2010f) and colleagues, and results are included in Table 1.32 of this document.*

Table 1.22 Summary table of results of herbal products analysed

Product name	Psychoactive ingredient (PI)	PI Listed in ingredients?	Packaging stated 'Not for human consumption'
Packet of herbal material	Several uncharacterised substances	n/a*	No

** n/a (Not applicable as result for product was not confirmed).*

Table 1.23 below summarises the results of the analysis of the seven products tested prior to the May 2010 Order.

Table 1.23 Results of analysis of products purchased before and after the May 2010 Order

Pre-ban product	Type of product	Main psychoactive component (PI)	PI listed in ingredients?	Packaging stated 'Not for human consumption'
AS5RT6FYG7HUJIL 'Blow'	Powder	Mephedrone	n/a*	Yes
'Doves'	Tablet	Butylone	n/a	Yes
'Magic'	Powder	Mephedrone	n/a	Yes
Mephedrone (bought online)	Powder	Mephedrone	n/a	Yes
'Smoke XXX'	Herbal	Several uncharacterised substances	n/a	Yes
'Snow'	Powder	MDPV**	n/a	Yes
'Wildcat'	Powder	Mephedrone	n/a	Yes

* n/a (Not applicable as either no ingredients listed or no confirmed results from analysis).

** MDPV: Methylenedioxypyrovalerone.

1.18 Discussion

The results of the analyses undertaken are based on matches achieved through mass spectra libraries and mass spectra sourced from other agencies. Due to the lack of reference standards for the substances, results may be considered tentatively. A total of 42 'legal high' products were tested prior to the May 2010 Order.

The following is a summary of the findings gleaned from analyses of the 42 products tested.

1.18.1 Caffeine

Table 1.24 illustrates the prevalence of caffeine in the products analysed. It should be noted that although caffeine is a psychoactive substance, the Criminal Justice (Psychoactive Substances) Act 2010 does not apply to caffeine.

Table 1.24 Number and proportion of products containing caffeine

Caffeine	Number	Percentage of total product
Caffeine only present	9	21
Caffeine present along with other substance(s) (as the main constituent or otherwise)	17	40
Total caffeine	26	61

n=42.

Caffeine (3, 7-dihydro-1, 3, 7-trimethyl-(1*H*)-purine-2, 6-dione) is a psychoactive substance (a stimulant) and 'is the most widely used psychoactive substance in the world'. According to Daly Holmén and Fredholm (1998) 'in Western society, at least 80 per cent of the adult population consumes caffeine in amounts large enough to have an effect on the brain' (p 5878). Fatalities can occur when levels of 5 to 50g of caffeine are ingested, and evidence seems to suggest an addictive quality to caffeine in that withdrawal symptoms arise in some individuals on cessation of usage. In addition, caffeine is used as a diluent in illicit drugs and is considered to extend the physiological effects of amphetamine (King, 2009).

The Food Safety Authority of Ireland (FSAI) states that drinks that contain in excess of 150mg of caffeine per litre must also provide a warning message on the label. This must be followed by an indication of the caffeine content, e.g. 'high caffeine content (x mg/100ml)' (FSAI, 2007). The US Food and Drug Administration (FDA) has limits on the caffeine content of soft drinks in the range of 71mg per 12 ounce can. 'Energy' drinks are exempt from these limits. The levels of caffeine that can be present in 'energy' drinks can be up to 500mg. To date, very little research has been conducted on the effects of caffeine in children and adolescents, considering the large increase (70%) since the late 1970s, of caffeine consumption in this age group. Thus the minimum 'safe' level of caffeine consumption in this age group is not known (Temple, 2009).

1.18.2 Controlled substances

The following tables 1.25–1.27 illustrate the nature and extent of substances which are controlled under the March and May 2010 Orders and were detected during the analyses.

Table 1.25 Number and proportion of products containing controlled substances (purchased in head shops after the May 2010 Order)

Controlled substances	Number	Percentage of total products analysed
MDPV	2	5
Total MDPV	2	5

n=37.

Table 1.26 Number and proportion of products containing controlled substances (purchased in head shops before the May 2010 Order)*

Controlled substances	Number	Percentage of total products analysed
MDPV	1	17
Mephedrone	4	67
Butylone	1	17
Total controlled substances	6	100

n=6. * These substance were not controlled at the time of purchase.

The herbal smoking product, 'Smoke XXX' was not included in the results for products tested prior to the Orders, as the substances it contained were uncharacterised.

Table 1.27 Number and proportion of controlled substances in the online products (products delivered/tested in time frame)

Controlled substances	Number	Percentage of total products analysed
MDPV	1	20
Mephedrone	2	40
TFMPP	2	40
Total controlled substances	5	100

n=5.

All ten products purchased via the Internet (from four different suppliers) were delivered (100%). However, only two companies delivered (five products) in sufficient time for analysis in the current review.

- Five out of five products purchased online (100%) contained substances controlled under the May 2010 Order.
- Two out of 37 products (5%) bought in Irish head shops after the May 2010 Order contained controlled substances.
- Six out of six products (100%) tested before the May 2010 Order contained substances subsequently controlled with the Order.

1.18.3 Emerging psychoactive substances

In total, the analyses carried out for this review indicated the presence of five newly emerging psychoactive substances (all identified since the May 2010 Order).

These substances were as follows:

- Dimethylcathinone (Metamfepramone)
- Naphyrone (Naphthylpyrovalerone)
- Fluorotropacocaine (8-methyl-8-azabicyclo[3.2.1]octan-3-yl)4-fluorobenzoate)
- Desoxypipradrol (2-diphenylmethylpiperidine)
- DMAA (dimethylamylamine)

Table 1.28 summarises the findings.

Table 1.28 Number and proportion of newly emerging psychoactive substances*

Newly emerging psychoactive substances	Number	percentage of total products analysed
Dimethylcathinone	2	5
Naphyrone	5	12
Fluorotropacocaine	1	2
Desoxypipradrol	1	2
Dimethylamylamine (DMAA)	3	7
Total emerging psychoactive substances	12	29

n=42. * Substances identified after the May 2010 Order.

1.18.4 New psychoactive substances via the Internet

A number of products were purchased online by the researchers. All five of the products that were delivered in time for analysis contained substances controlled under the May 2010 Order. The sample is small and cannot be considered representative.

The two websites from which products analysed were received provided different kinds of information in relation to the products sold. This is illustrated in Table 1.29 below. Both websites claimed that their products are not for human consumption, or that all products featured on the sites are included for novelty value only, and that all seeds are sold for scientific research or as souvenirs only. The issue of legality was mostly left up to the customer to interpret with quotes such as the following:

> 'Buyer understands that Seller's offer of any product is void where prohibited, and that it is Buyer's own responsibility to check and abide by local, state/province and government laws and regulations in accordance with the use of any product provided by MysteriousPlants.com. Buyer agrees to make no attempt to hold Seller liable for anything that may happen to a delivery while en route, and Buyer understands that since Seller cannot know of all laws for all countries, it is entirely Buyer's responsibility to make certain that the products ordered are allowed in Buyer's country of residence' (*http://www.mysteriousplants.com*).

Minimal or no information was provided in relation to dosage or health. Where information was provided, it tended to be vague and misleading, as illustrated by the following example:

> 'As long as these products are enjoyed responsibly and in moderation, there is no harm, just as with alcohol or cigarette. Always follow the recommended dosage specified on the packet'.

Attempts to compare products with illegal counterparts were also observed:

> 'These products are designed to give effects that are as close as possible to their illegal counterparts; however our products are also better in many ways. They contain healthier natural ingredients. Each product contains a qualified dose. You can't get nicked with these in your pocket. Some of our customers are now claiming that certain products are as good as the real thing, some says it is even better.' (*http://www.mysteriousplants.com*)

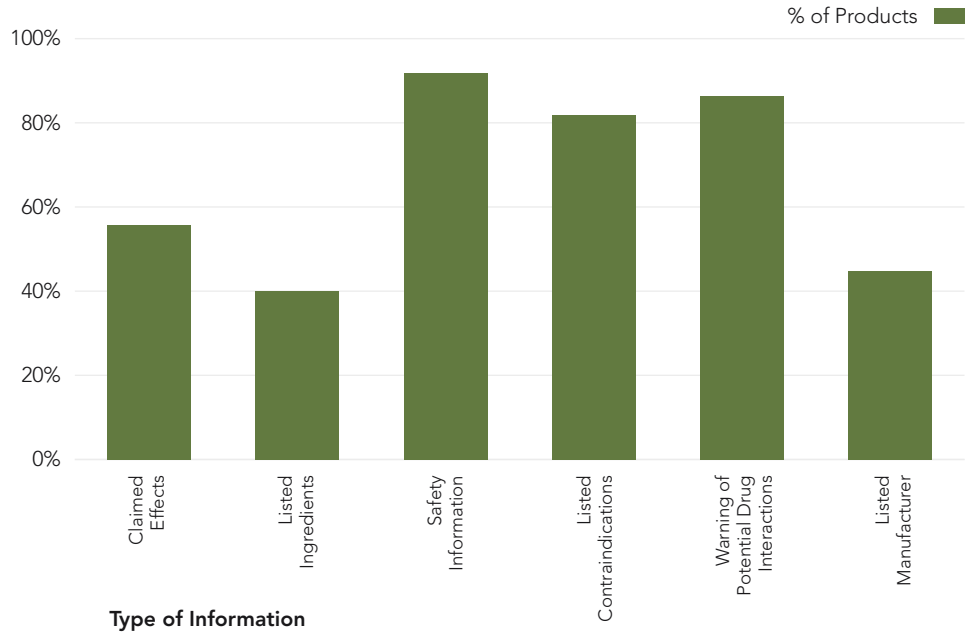
Table 1.29: Information provided on the two websites

Information provided:	Website A	Website B
Age limit (over 18)	Yes	Yes
Duration of effects	Yes	No
Dosage	No	No
Effects	No	No
Health warnings	No	No
Legality of product	Yes	Yes

Very few scientific papers have been published on the availability of psychoactive substances ('legal highs') on the Internet in Europe (EMCDDA, 2009; Schmidt *et al.*, 2010; The Psychonaut 2002 EU Project, 2002). In addition, few studies have evaluated the product information that is provided to customers by these websites. One recent study (Schmidt *et al.*, 2010) assessed 105 websites for products and product information and found that of the 1,308 products examined, 730 (55.8%) contained information on effects, and 524 products (40.1%) did not list ingredients. Similar to the findings in this review, products that listed ingredients tended to list several different plant/herb extracts (i.e. 'proprietary blends'). The study also found that in some cases products listed the same substances in different ways. For example, either the active ingredient was listed (e.g. ephedrine) or the plant name (e.g. Ma Huang) or the botanical name (e.g. *Ephedra sinica*) was listed. Consistent with findings in this review, the 2010 Schmidt study emphasises that 'results should be treated with caution because the makeup of a product may change over time'[11]. With respect to products listing safety information, it was found that almost 92% of products did not list any. The products that attempted to list safety information did so in a very vague manner, such as 'can make you feel a bit rough' and 'may function as a CNS stimulant'. The information described here is displayed graphically below.

11 Further discussion of this issue follows.

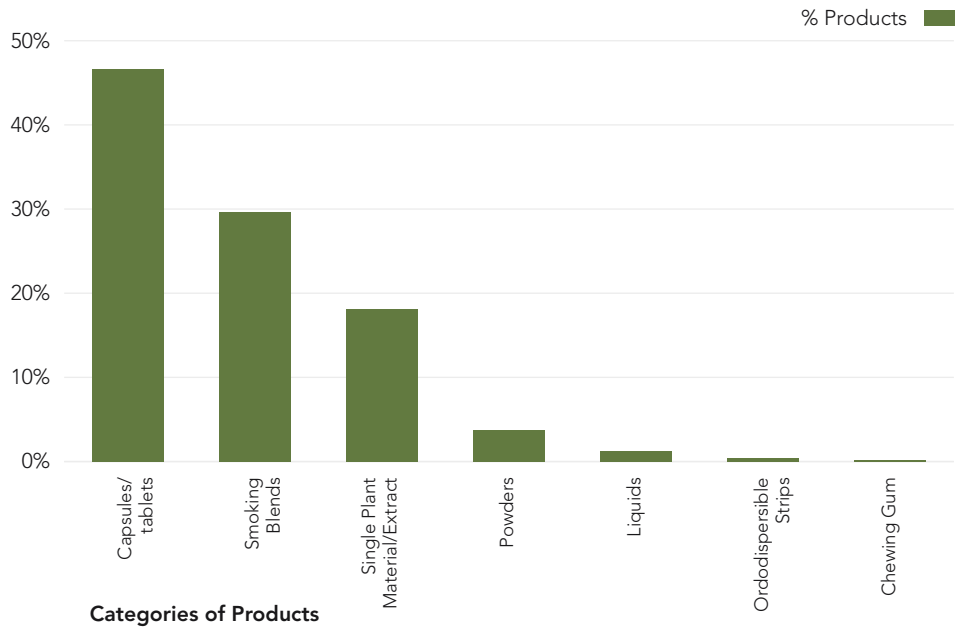
Figure 2: % of information not listed on products purchased online



Schmidt and colleagues (2010) found that the majority of the products for sale online were in tablet or capsule form (609), followed by smoking blends (389), single plant material/plant extract (237), powders (48), liquids (16) and others (8). The categories of products are displayed graphically below as a percentage of the total product number (1,308) examined.

Figure 3: Breakdown of the categories of products available in %

% of Products in Categories



1.18.5. Consistency of products over time

Analyses of products carried out during the course of this review showed that product content can change over time. This was evident in the case of 'Wildcat', which, when tested in April 2010, was found to contain mephedrone. However, when tests were subsequently carried out on a product of the same name purchased in June 2010, they showed that the product contained MDPV. In the intervening period both mephedrone and MDPV had been placed under control by the May 2010 Order. Similar inconsistency was observed in the product 'Ivory Wave'. Analysis of 'Ivory Wave' carried out by DIT researchers indicated the presence of MDPV and lignocaine, while analysis carried out by the Forensic Science Laboratory (FSL) found the presence of MDPV and either tolycaine, or lignocaine. Kavanagh and colleagues found that 'Ivory Wave' contained naphyrone (2010f). The 'Ivory Wave'product tested by DIT was purchased online after the May 2010 Order, by which time MDPV was a controlled substance. The 'Ivory Wave' product tested on a later occasion by Kavanagh and colleagues (2010f) was found to contain naphyrone, which was not covered under the May 2010 Order.

Other products which demonstrated inconsistency included 'White Columbia', 'Flake' and 'Mind Melt'. When tested initially by Kavanagh and colleagues, 'White Columbia' was found to contain ethcathinone (2010b, 2010d); however, during a later analysis it was found to contain buphedrone (2010f). Prior to 2010, buphedrone had not been encountered in the literature. 'Flake' was tested before the May 2010 Order and found to contain butylone. In tests carried out after the ban, 'Flake' was found to contain dimethocaine. Analysis of 'Mind Melt' indicated the presence of dimethocaine on one occasion and naphyrone on another occasion (Kavanagh *et al.*, 2010d).

Tables 1.30–1.32 present the results of chemical analyses performed by DIT, the FSL, Kavanagh and colleagues, as well as the results of analyses carried out by DIT using the TICTAC database. These results serve to further highlight inconsistencies in the content of head shop products. The analyses were done at different points in time, and each analysis was carried out on a unique product. The findings indicate that consumers cannot be sure that a product consumed on one occasion will contain the same substances as the same named product consumed on another occasion.

Table 1.30 Results of analysis of tablets received in respective laboratories at different points in time

Tablets	DIT	TICTAC	FSL	Kavanagh and colleagues
'5-HTP'	Several uncharacterised substances	–	–	–
'Bio-Happiness'	Caffeine	–	Caffeine	Caffeine, Synephrine
'Blessed'	Caffeine and an uncharacterised substance	–	Caffeine	–
'Charged'	Caffeine	–	Caffeine	–
'Diablo'	Caffeine	–	Caffeine	DMAA, 2-PEA, Caffeine
'Doves'	Butylone	–	Butylone	Butylone

Table 1.30 Results of analysis of tablets received in respective laboratories at different points in time (continued)

Tablets	DIT	TICTAC	FSL	Kavanagh and colleagues
'E=XTC'	TFMPP	BZP/TFMPP/ DBZP	BZP/TFMPP/ DBZP	–
'Exotic PH1'	Caffeine, Hordenine and one uncharacterised substance	–	–	DMAA, 2-PEA, Caffeine, Synephrine, Hordenine
'Exotic PH1A'	Caffeine, Hordenine and one uncharacterised substance	–	–	DMAA, 2-PEA, Caffeine, Synephrine, Hordenine
'Exotic PR1'	Caffeine, Hordenine and one uncharacterised substance	–	–	DMAA, 2-PEA, Caffeine, Synephrine, Hordenine
'Exotic SM1'	Caffeine, Hordenine and one uncharacterised substance	–	–	DMAA, 2-PEA, Caffeine, Synephrine, Hordenine
'Fuel'	Caffeine, Hordenine and one uncharacterised substance	–	–	–
'Iced Diamonds'	Caffeine and one uncharacterised substance	–	Caffeine	–
'Infernal'	Caffeine	–	Caffeine	–
'Mind Candy'	TFMPP	BZP/TFMPP/ DBZP	BZP/TFMPP	–
'Storm'	Caffeine, Hordenine and one uncharacterised peak	–	–	DMAA, 2-PEA, Caffeine, Synephrine

DMAA: Dimethylamylamine; 2-PEA: 2-Phenethylamine; TFMPP: 1-(3-Trifluoromethylphenyl) piperazine; BZP: 1-Benzylpiperazine; DBZP: 1,4-Dibenzylpiperazine.

Table 1.31 Results of analysis of capsules received in respective laboratories at different points in time

Capsules	DIT	TICTAC	FSL	Kavanagh and colleagues
'BluE'	Dimethylcathinone, Caffeine	–	Caffeine	Dimethylcathinone (metamfepramone) and Caffeine
'Embrace'	DMAA, Caffeine	–	Caffeine	DMAA, Caffeine
'Empathy'	DMAA, Caffeine	–	Caffeine	DMAA, Caffeine, Synephrine
'Golden Root'	Several uncharacterised peaks	–	Caffeine	–
'Magic'	Benzocaine, Caffeine	–	Mephedrone	Benzocaine, Caffeine
'NRG Now'	Caffeine	Caffeine	–	Caffeine
'Orbit'	DMAA, Caffeine, Hordenine, Theobromine	–	Caffeine, Hordenine, Theobromine	Octapamine, Caffeine, Synephrine, DMAA, Hordenine
'Party On'	Caffeine and one uncharacterised substance	Caffeine	–	2-PEA, Caffeine
Vegas Nights	Caffeine	–	Caffeine	–

DMAA: Dimethylamylamine; 2-PEA: 2-Phenylethylamine.

Table 1.32 Results of analysis of powders received in respective laboratories at different points in time

Powders	DIT	TICTAC	FSL	Kavanagh and colleagues
'100% Pure'	Dimethylcathinone, Caffeine	–	–	Ethcathinone
'Blow'	Mephedrone	–	Mephedrone/ Benzocaine	–
'Blowout'	Caffeine	–	Caffeine	Caffeine
'Cristalius'	Mephedrone	–	–	–
'Duffy's Hysteria'	Naphyrone, Caffeine	–	–	Naphyrone, Caffeine
'Enchanted (NS)'	Naphyrone	–	–	Naphyrone
'Enchanted (SS)'	Naphyrone	–	–	Naphyrone
'Ivory Wave'	MDPV and Lignocaine	–	MDPV/Tolycaine/ Lignocaine	MDPV, Lignocaine/ Naphyrone

Table 1.32 Results of analysis of powders received in respective laboratories at different points in time (continued)

Powders	DIT	TICTAC	FSL	Kavanagh and colleagues
'Magic'	Mephedrone	–	–	–
'Mephedrone'	Mephedrone	–	–	–
'Plan B'	Mephedrone	–	Mephedrone	–
'Platinum'	Naphyrone	–	–	Naphyrone, Caffeine
'Pure NRG'	Naphyrone	Caffeine and Lidocaine	–	Naphyrone, Caffeine (also suspected the presence of 1-naphyrone)
'Rush'	MDPV	–	–	Fluorotropacocaine
'Snow'	MDPV	–	Methylone	Fluorotropacocaine, Caffeine, Lognocaine or Lignocaine
'SnowBlow'	Caffeine	–	Caffeine	Caffeine
'Stardust Extreme'	Caffeine	–	–	Fluorotropacocaine and Caffeine
'Whack'	Fluorotropacocaine, Desoxypipradol	–	Fluorotropacocaine and Desoxypipradrol	Fluorotropacocaine and Desoxypipradrol
'White Columbia'	Two uncharacterised substances	–	–	Ethcathinone (iso-ethcathinone), Buphedrone (07-08/2010)
'White Fizz'	Caffeine and several uncharacterised substances	–	–	MDPBP, Caffeine, 4-MEC, Benzedrone, Pentylone
'Wildcat' (before-11/05/10)	Mephedrone	–	–	Mephedrone, Caffeine, Benzocaine
'Wildcat' (after 11/05/10)	MDPV	–	Mephedrone/ Benzocaine	–

MDPV: Methylenedioxypyrovalerone; MDPBP: 3',4'-Methylenedioxy-α-pyrrolidinobutiophenone; 4-MEC: 4-Methylethcatinone; Benzedrone: 4-Methyl-N-benzylcathinone.

1.19 Conclusion

New psychoactive substances or 'designer drugs' regularly appear on the market, which continues to develop at a dramatic pace. Historically, other areas of the drug market have also shown a pattern of constantly evolving and innovating – witness developments such as fentanyl-based drugs in the 1980s, ring-substituted phenethylamines and tryptamines in the 1990s, and piperazines and cathinones during the last ten years. The era of the Internet, new and improved technological developments, increased access to scientific literature and inexpensive organic synthesis techniques have all accelerated the development of new psychoactive substances. As a result, the scientific community is obliged to play catch-up.

The DIT team's recent review of head shop products produced a number of key findings. As follows:

A wide range of new psychoactive substances was identified as available on the Irish market. Chemical analyses of products purchased in head shops and online revealed substances (e.g. desoxypipradol) which had not been identified in Irish head shop products previously. In particular, analyses detected the emergence of five new substances after the May 2010 Order: dimethylcathinone, naphyrone, fluorotropacocaine, desoxypipradrol and dimethylamylamine. Naphyrone was the most frequently detected of these. Little scientific data is available on these new psychoactive substances.

While a comparison of substances identified before and after the May 2010 Order indicates that suppliers moved quickly to replace controlled substances with new uncontrolled substances, nevertheless, one of these substances (MDPV), which is controlled under the May 2010 Order, was detected in two of the 37 products purchased in Irish head shops after May 2010. The five products purchased online, and which were subjected to analyses, all contained controlled substances (MDPV, mephedrone and TFMPP). Thus, it appears that head shops may respond to local control measures more quickly than they may do with international online suppliers. As a consequence, consumers purchasing new psychoactive substances online in particular may unintentionally put themselves at risk of engaging in illegal activity.

Analyses further revealed that a lack of consistency in the psychoactive content of head shop products is common. Consumers cannot assume that two items with the same product name and packaging contain exactly the same substance(s). Thus someone who consumes what appear to be two identical products on two different occasions may experience quite different effects if the products were purchased in different time frames – as little as a few days or a few weeks apart. In addition, products tend to be poorly labelled in terms of their ingredients, dosage and 'safety'information and so on. These factors have implications for consumers, including the potential for misuse, adverse reactions and possible overdose.

2 A survey of head shops

The number of head shops nationwide is being monitored by the Garda National Drugs Unit 'Operation Kingfisher'. The most recent report (Kingfisher 6, 2nd to 4th October 2010) identifies ten head shops nationwide, none apparently selling psychoactive substances. This represents a considerable decline from the 100+ head shops that existed prior to the May 2010 Order; the 39 outlets reported in Kingfisher 4 (14th July 2010), and the 19 outlets reported in Kingfisher 5 (2nd to 3rd September 2010). The remaining ten outlets are listed in Table 2.1 and are illustrated on the map in Figure 2.1.

Table 2.1: Head shops nationwide known to An Garda Síochána 2 to 4 October 2010

	Dublin	
1.	New Age Hemp	Tallaght, Dublin 24
2.	Hemp Company	Capel Street, Dublin 1
	Co Kildare	
3.	Baam Saabei	Naas
	Cork city	
4.	The Funky Skunk	6 Lavitts Quay, Cork
5.	MMad	North Main Street, Cork
	Co Kerry	
6.	The Funky Skunk	High Street, Killarney
	Co Laois/Offaly	
7.	Vegas	Portlaoise
	Limerick city	
8.	The Dark Side	Foxes Bow, Limerick
9.	Deeproot Gardening	Mungret Street, Limerick
	Tipperary	
10.	Hemp Shop	40 Upper Gladstone Street, Clonmel

The situation was fluid during the summer and early autumn of 2010. While the total number of head shops declined during June and July (from 48 on 10 June 2010 to 39 on 14 July 2010), a number of new shops have opened since 10 June 2010. However, as can been seen above, most have now closed and only ten outlets remain[12].

The Criminal Justice (Psychoactive Substances) Act came into effect on 23 August 2010. This law makes it an offence to sell, import or export a psychoactive substance. The very wide definition of psychoactive substances goes far beyond previous bans in Ireland and elsewhere in Europe, where specific compounds, often very narrowly defined, were banned. Press reports on 24 August 2010 indicated that all head shops nationwide were closed. As detailed above, ten have since reopened, selling pipes, bongs and clothing. None are selling psychoactive substances and only one (Deeproot Gardening, Limerick) was observed to have hydroponic equipment on display.

12 Although they do not appear in the Kingfisher 6 list above, 'Nirvana' on South William Street, Dublin and the 'Dublin Head Store', Temple Bar, Dublin were open at the time of writing (early November 2010).

Figure 2.1 Head shops nationwide (October 2010)

2.1 Internet outlets

Regardless of the number of head shop retail outlets in Ireland, purchases may still be made from online outlets. There are thousands of such websites. There are also many ways in which search terms can be defined in order to locate the sites. For example, consumers may use general search terms such as *'legal highs'*[13], *'herbal highs'*, *'research chemicals'*, *'social tonics'*, or they may use substance-specific terms such as *'mephedrone'*, *'DMAA'*, *'smoke'*. It is thus extremely difficult to estimate the number of online outlets for new psychoactive substances.

To give an indication of the number of online outlets distributing to Ireland, the Google search engine was used to search the Internet using the terms *'buy legal highs'*, *'legal highs'*, and *'head shop'*.

The search term *'buy legal highs'* returned 335,000 hits, and the top 20 of these websites was examined. Within the 20 websites, 11 different sites appeared to be selling new psychoactive substances. Out of these 11 sites, nine appeared to deliver to Ireland; this was determined by their explicit statement of delivery to 'Europe', 'Worldwide', and 'Ireland', and/or as a result of Ireland not being listed among excluded countries. In the case of the remaining two websites (out of 11 examined), the delivery information was not readily available.

13 The term *legal highs* is likely to be more familiar to users of new psychoactive substances than is the term *new psychoactive substances*, and so it was employed as a search term in this context.

When the Google search option 'pages from Ireland' was selected with the search term (*'buy legal highs'*), none of the above 20 websites appeared to be selling new psychoactive substances. When the search term was changed to *'legal highs'* ('pages from Ireland'), just one website appeared to be selling new psychoactive substances; this was an Irish site and it claimed to deliver within Ireland.

Using the term *head shop* with the search option 'pages from Ireland', two of the above 20 websites appeared to be selling new psychoactive substances, and one of the sites claimed to deliver within Ireland. When the term *head shop* was searched with the 'world wide web' option, three of the first 20 websites appeared to be selling new psychoactive substances; two of these to Ireland.

The exercise described above represents nothing more than preliminary findings from an Internet trawl using basic search terms.Within the relatively limited scope of this research, it was not possible to verify whether the suppliers on each of the sites identified delivered to Ireland. It is clear that there are thousands of online outlets for new psychoactive substances. However, the task of identifying, examining, and verifying each outlet and determining whether they deliver to Ireland would be a substantial undertaking.

For the purposes of this study, several new psychoactive substances were purchased from four different websites. The websites and substances were selected on the basis of popularity, ease of use/purchase, geographical location and the selection of products on offer.

The aim of the study was to discern the ease with which new psychoactive substances could be purchased online by Irish users; the veracity of the website operators in delivering the goods; the mode and speed in which the products were packaged and delivered; whether the products would be intercepted en route, and also to test the websites' claims that the 'legal highs' on sale were 100% legal in Ireland (or indeed in the EU, as was stated in some cases).

Table 2.2 lists the websites, the products purchased, the date they were ordered and whether or not they were received in time for analysis.

Table 2.2: Products purchased online by the DIT researchers

Product	Website	Date ordered	Received in time for analysis
Ivory Wave	*www.mysteriousplants.com*	21/07/2010	Yes
Plan B	*www.mysteriousplants.com*	21/07/2010	Yes
E=XTC	*www.mysteriousplants.com*	21/07/2010	Yes
Mind Candy	*www.mysteriousplants.com*	21/07/2010	Yes
Cristalius	*www.weedwholesale.com*	22/07/2010	Yes
Shake and Vac	*www.herbalaromas.com*	27/07/2010	No
Fairy Dust	*www.herbalaromas.com*	27/07/2010	No
Ocean Snow Ultra	*www.am-hi-co.com*	27/07/2010	No
Recharge Extra	*www.am-hi-co.com*	27/07/2010	No
Red Doves	*www.am-hi-co.com*	27/07/2010	No

Each of the four website suppliers from which products were purchased succeeded in delivering the particular products ordered. In the case of two suppliers , however, the products were delivered outside the time frame i.e. too late for analysis. The study sample is too small to enable the review team to conclude whether or not online retailers reliably supply to Irish postal addresses.

The package from *'www.mysteriousplants.com'* was posted from Belgium and travelled through Budapest. The package from *'www.weedwholesale.com'* was posted from the Czech Republic. The websites offered payment options of Alert Pay, Sage Pay, or transfer from a bank account or by Western Union etc. The results of the analysis of these products have been included in Part One (see also Supplementary Information[14], Chemical reporting form for 'legal highs' analysed). As detailed elsewhere, these findings showed that all five substances ordered online and delivered to a Dublin postal address contained banned substances.

Future prominence of the Internet for accessing new psychoactive substances

The Internet is used by 67.6% of European citizens (Internet World Stats, 2010). In Ireland, it is used by 65.8% of the population (just over three million people), a 288% increase since 2000. A European Commission survey found that the Internet is the most popular source of information about illicit drug use and drug use in general among 15 to 24 year olds (The Gallup Organization, 2008, cited in Hillebrand *et al.*, 2010). It is likely that the Internet will become the primary source of psychoactive substances for Irish people. It is likely that the closure of head shops will have a greater impact on casual users or new users. Long-term or 'career' drug users were attracted to synthetic cannabinoids (such as 'Spice') due to their legality and availability (Hammersley, 2010). Once these products are withdrawn from the market, such committed users are likely to switch back to illegal drugs (Measham *et al.*, 2010).

The creation of synthetic psychoactive drugs has been underway for years. However, what is novel about recent developments in the synthetic psychoactive drugs market is the informational and distributional capacity of the Internet:

> 'Substances have been produced and marketed with the explicit aim of circumventing legislative restrictions for several decades. What has changed is an increase in their range, potency, profile and availability. The development of global web-based marketing and distribution networks, as distinct from illegal street markets, has emerged concurrently, challenging further the utility of existing supply reduction strategies' (Winstock and Ramsey, 2010, p 1).

A literature is emerging on the role of the Internet in the use of new psychoactive substances. For example, Davies *et al.* (2010) describe the consistency of products. They purchased 26 products each month, for six months, from UK websites. They reported that initially all products purchased were delivered. However, in each subsequent month, the delivery of products declined. Of products delivered more than once, there was no change in composition in 15 (75%) cases. In three products, there was a change in the piperazine detected. In two other products, a cathinone was found in the initial products delivered, but not in subsequent deliveries. It is interesting to note that a number of products were found to contain caffeine only ('Pure Bliss', 'Party On', 'Hummer Energy Pills'). In relation to reliability of delivery, Davies *et al.* (2010) report 'in several hundred Internet purchases we have only one example where a company has taken our money and not delivered the goods … In our experience you cannot fault them for customer service!' [personal communication].

14 Supplementary information supplied with this report consists of 1) report forms detailing each product that underwent chemical analysis; and 2) mass spectra results for the various products analysed.

Boyer *et al.* (2007) describe how 'innovative drug users' use the web to learn about new products, experiment and give feedback, tips and advice to others. In an Irish context, we noted Irish users were actively discussing new psychoactive substances on 'boards.ie', 'bodytonicmusic.com' and 'drugs-forum.com'.

Hillebrand *et al.* (2010) report on an EMCDDA investigation into EU-based online drug retailers. A total of 69 retailers were identified. Most were based in the UK and the Netherlands (52% and 37% of the total, respectively). A sample of 27 retailers was selected for further analysis. Over 500 products were available for sale, many described as 'herbal' or 'natural', implying 'harmlessness'. *Salvia divinorum* was available in 74% of the selected sites. 'Kratom' was also widely available in 44% of the selected sites. The information about products varied widely from site to site. About 40% of the sites analysed contained no information about potential negative effects, while just over half the sites provided warnings about concurrent use of alcohol and/or medication. Over half the sites (63%) provided information on ingredients, but "information about main active ingredients and/or quantities was lacking" (p 336). Information on dosage was typically provided, but was usually missing in the case of new products. Hillebrand *et al.* (2010) concluded that the online market for new psychoactive substances should be 'closely followed' and

> 'Systems should be developed to assess the information provided by retailers, and to ensure the accuracy and objectivity necessary for Internet users. Retailers themselves should also bear some responsibility and should provide information on effects and dosages' (p 337).

Assuming that the number of head shops in Ireland decreases further, it would appear that the 'future is online' in terms of accessing psychoactive substances. How can policy makers in Ireland respond to this issue? It is interesting to note the approach used in the United States. For example, in 2004, in 'Operation Web Tryp', the DEA arrested ten operators of five different websites found to be selling 'research chemicals' that were designer drug analogues, primarily sourced from China and India[15]. The press release from the US Attorney's Office[16] states that one of these websites collected US$567,765 from May 2002 to September 2003. The operation involved undercover DEA agents purchasing controlled substances from the operator of one website, who offered to deliver goods personally to them in New York.

Conclusion

The Criminal Justice (Psychoactive Substances) Act is a bold approach to dealing with the existence of head shops, which are widely perceived by communities, politicians and the media to be an unwelcome addition to Ireland's retail landscape. We can speculate that the Act will have a number of effects. Firstly, it has already resulted in a rapid and marked decrease in the number of head shops nationwide. The few remaining outlets do not appear to be selling psychoactive substances. It is likely that there will be a concomitant decrease in the use of psychoactive substances by casual, young and first-time users, and an associated decrease in presentations to hospital emergency departments. Secondly, habitual drug users who were attracted by the legality and easy availability of head shop products are likely to return to 'traditional' illegal substances. Thirdly, a proportion of head shops' customer base will take their business online, where chatrooms and blogs will keep them updated with new products, perceived effects, and recommended sources and avenues of delivery. However, it should be noted that the provisions of the Criminal Justice (Psychoactive Substances) Act include, under section 3(2), a prohibition on the unauthorised importation or exportation of psychoactive substances for human consumption (as defined in the Act). This is intended to include any such importation or exportation conducted by online means.

15 *http://www.justice.gov/dea/pubs/pressrel/pr072204.html*

16 *http://www.justice.gov/usao/nys/pressreleases/July04/curtisdesignerdrugpr.pdf*

3 User experience

Published data in relation to a range of new psychoactive substances and their effects are reviewed in this section.

This review is followed by an overview of literature relating to patterns of use of new psychoactive substances. Findings are then presented from the study, which involved an online survey of 'legal highs'[17] use and brief qualitative interviews with users of new psychoactive substances as well service providers. The research aimed to gain an understanding of the use of, and effects of, new psychoactive substances – both existing substances and emerging substances – in the Irish context.

3.1 New psychoactive substances and their effects

Since 2007, more than 90 new psychoactive substances have been reported through the EMCDDA Early Warning System (EWS). In 2009 alone, 24 new psychoactive substances, all of which were synthetic, were officially notified for the first time in the EU through the EWS. New substances are being synthesised and older 'research chemicals' are being resurrected at a rapid pace in order to circumvent legislative manoeuvres towards the control of new psychoactive substances. Over the past six years, a greater diversity of chemical structures has been appearing (Long, 2010). Typically, these are designed to mimic stimulants, cannabis and, less commonly, hallucinogens. Although these substances are designed to impersonate more familiar illegal substances whose effects have to some degree been documented, the immediate, short- and long-term impacts of these new substances are not yet known. While a body of knowledge is growing , this knowledge is naturally chasing trends in the consumption choices of users of new psychoactive substances and the availability of those substances. If interventions are to be appropriate and effective, it is important that they are informed by evidence, and therefore a challenge exists for those charged with responding to the issue.

In the absence of rigorous testing in controlled environments, there are inherent difficulties in attempting to establish the effects of new psychoactive substances on consumers in general. Complicating factors include, among others, effects which are specific to certain individuals only, effects which are associated with a particular substance or product only, and effects which are associated with the testing and identification of the substance. Subjective accounts of user experience must be interpreted in light of individualised patterns of use; polydrug use; the consumption of 'unknown'[18] substances; personal expectations for the substance and the setting of use (Zinberg, 1984); pre-existing physical or mental health conditions; and personality and individual differences. The picture is further complicated by the adoption of generic names for substances that differ, such as has been reported with 'Amplifier'.[19] As highlighted previously in this report, products themselves may lack consistency in their constitution and tend to be poorly and inaccurately labelled (e.g. Brandt, Sumnall, Measham, and Cole, 2010), thus making reliance on self-reports problematic.

17 The term *legal high(s)* replaced *new psychoactive substances* for the purpose of the empirical research, as it was deemed to be a term more familiar to research participants. As a result, the term legal highs, where used throughout this section of the report, refers to new psychoactive substances available both before and after the ban (May 2010).

18 'Unknown' substance in this context refers to a substance or product which an individual consumes intentionally without prior knowledge of its actual or alleged contents.

19 *'Amplifier'* may be used by problem drug users as a reference to all new psychoactive substances in powder form (Ana Liffey Drug Project, personal communication).

In addition to a lack of consistency, new psychoactive substances sold in head shops or online may contain a mix of substances both synthetic and herbal. Thus, interactions among multiple substances within products, and also with other substances consumed simultaneously, are possible. Individuals who present at hospitals and who may have ingested these substances are not routinely sent for toxicological screening. For individuals who do come to the attention of toxicologists, difficulties may arise with regard to detection. Reference standards and analytical data may not be immediately available for new designer chemicals, and laboratories may not be fully equipped to undertake analyses (King, 2009). Substances may also be active at such low doses that detection is rendered especially challenging (King, 2009). In addition, the toxicological interview itself can face obstacles due to a patient's state of consciousness, or a patient's reluctance or refusal to admit to substance use (Klimaszyk and Nawrocka, 2009). Thus, on the basis of user reports and clinical toxicity reports, it can be difficult to accurately gauge the health-related harm resulting directly from the consumption of new psychoactive substances.

While anecdotal accounts of the effects of new psychoactive substance are plentiful[20], published data are scarce, due both to the recency of the phenomenon and the speed with which new compounds appear on the market. Prevalence data are also scarce and may not become available for some time, as national surveys begin to address the issue. Some published information does exist for the more established pre-ban (May 2010) substances, such as mephedrone and BZP (e.g. Gee, Richardson, Woltersdorf, and Moore, 2005; Wood, *et al*., 2009; 2010). Explorations of the experiences of users of these substances are also available (e.g. Newcombe, 2009; Van Hout and Brennan, in press, a).

A review of published data on new psychoactive substances was undertaken and the findings are set out below. The new psychoactive substances described have been identified in the Irish context prior to August 2010[21] and/or were reported as sampled by users surveyed as part of this review[22].

Naphyrone (naphthylpyrovalerone)

Since the banning of mephedrone in May 2010, there appears to have been an emergence of products alleged to contain naphyrone[23]. 'Pure-NRG' and 'Enchanted' are examples of such products and both were found to contain naphyrone during the course of this review and also in other research studies (Kavanagh *et al*., 2010b, 2010c, 2010d, 2010f). Naphyrone was marketed as a replacement for mephedrone in the wake of the May 2010 ban. As it is a relatively new compound, little is known about the effects of naphyrone and there appears to be no published data as of yet.

Naphyrone is a pyrovalerone derivative. As naphyrone is a stimulant structurally similar to the cathinones MDPV and mephedrone, it is possible that it may induce similar effects, although there is as of yet no evidence to suggest that it does. The ACMD (Advisory Council on the Misuse of Drugs) report on the naphthylpyrovalerone analogues (2010a) describes possible health risks of heart problems, hyperthermia and the potential for users to become dependent on the drug, but no published data support this. In addition, there is little information currently available on its toxicity or safety. However, the ACMD cautions that naphyrone is more potent than mephedrone and ecstasy and, as such, there may be an increased likelihood of overdose. The ACMD report states that naphyrone is a triple reuptake inhibitor (dopamine/serotonin/nor-adrenaline) and is ten times more potent than cocaine.

20 See *www.drugs-forum.com*; *www.erowid.org*; and *www.bluelight.ru*.

21 See the current review and also Kavanagh and colleagues (2010a, b) and Kavanagh, McNamara, Angelov, McDermott, and Ryder (2010).

22 Survey findings are presented elsewhere in this section.

23 See Section 1 for a review of products.

The product 'Ivory Wave' has received attention in the media for its reported link to the death of a young man in the UK[24]. The analysis of 'Ivory Wave' in the current review revealed the presence of MDPV (which was banned in Ireland in May 2010)[25]. No published data regarding the effects of MDPV exist as of yet (August 2010). Unpublished data from Finland (Forsell, 2010) has implicated MDPV in 16 deaths, and as a 'most important finding' in two of these. The presence of other substances of abuse was detected. Hospital emergency department reports described effects including tachycardia, agitation, shortness of breath and hypertension; among other effects, some psychotic features were described as being stronger than those observed from other stimulants, but shorter lived (Forsell, 2010).

DMAA (1,3 dimethylamylamine)

Also known as methylhexaneamine, geranium and floradrene, DMAA became a replacement for BZP party pills in New Zealand following their ban in 2008. Effects are therefore likely to mimic the stimulants ecstasy and BZP. DMAA was identified in 13 of 38 head shop products tested by Kavanagh and colleagues (June/July 2010)[26]: 'Go-E', 'Energy', 'Entrophy', 'Dr Feelgood', 'Hummer', 'Fast Layn', 'Nemesis', 'Pinkys', 'Crankd', 'Diablo', 'Molotov', 'Embrace' and 'BluE'. DMAA was found in the products 'Orbit', 'Embrace' and 'Empathy' during analyses undertaken as part of the current review. As is the case with other newly emerged and newly abused substances, published data on toxicological, pharmacological, psychological and behavioural effects of DMAA are scarce.

The New Zealand Expert Advisory Committee on Drugs (2009) considered the potential harm of DMAA and concluded that there may be potential for harm if the substance is administered in large doses and that this risk is 'consistent with that of other sympathomimetic substances in the event of overdose' (Expert Advisory Committee on Drugs, 2009 p 3). It was noted that the potential for harm may be exacerbated with routes of administration, such as injecting or snorting. It was further noted that the prevalence of use in the population was likely to be low. DMAA was not considered a major problem at that time (Expert Advisory Committee on Drugs, 2009). Published data were not available for this assessment. Gee and colleagues (2010) have since reported a case of DMAA toxicity in which a male presented with headache, confusion, incontinence, slurred speech, and cerebral haemorrhage 19 hours after ingesting DMAA, caffeine and beer.

User reports of undesirable effects associated with DMAA include profuse sweating, feeling depressed and paranoid, and an urge to use more of the substance, with more severe effects reported as headache, nausea and stroke (Long, 2010).

Dimethocaine (DMC, Larocaine)

Dimethocaine has a short history of recreational use, even though it has been available since the 1930s. It has similar anaesthetic-stimulant properties to cocaine and was originally used (under the trade name Larocaine) as an anaesthetic. Dimethocaine was identified as being present in the post-ban (May 2010) products 'Mint Mania', 'Mind Melt' and 'Amplified' (Kavanagh *et al.*, 2010b, 2010c, 2010d, 2010f), but was not identified in products analysed as part of the current review. As dimethocaine is an anaesthetic-stimulant, it is likely to have effects similar to other such drugs. This class of substance is associated with cardiotoxicity in particular. Published data with respect to the effects of dimethocaine in humans appears to be scarce. However, a number of psychopharmacological studies have observed the action of dimethocaine in rodents and monkeys.

24 The inquest into the death had not taken place at the time of writing.

25 Naphyrone was identified in 'Ivory Wave' by Kavanagh and colleagues (2010e). The August identification chart became available at the conclusion of the current research.

26 Also see Kavanagh and colleagues (2010e).

In one study, Rigon and Takahashi (1996) examined the effects of dimethocaine in mice, on behavioural tests which it was believed would be sensitive to cocaine action. Findings demonstrated 'locomotor stimulant, reinforcing and anxiogenic actions of dimethocaine similar to those reported for cocaine in animals' (p 323). The authors claimed the findings also indicated dopaminergic activity, rather than local anaesthetic action, in the behavioural effects caused by dimethocaine (Rigon and Takahashi, 1996). Findings from another study (Blatt and Takahashi, 1998) demonstrated impairment of some memory processes among mice in a plus-maze test. The authors also interpreted this study in light of non-anaesthetic mechanisms of action on memory impairment. Dopamine has long been implicated in the reinforcing effects of cocaine. Similarly, dimethocaine appears to act as a reinforcer, inhibiting dopamine re-uptake (Wilcox, Rowlett, Paul, Ordway, and Woolverton, 2000). As with all comparative research, the implications of these studies for human psychopharmacology should be interpreted with caution.

User reports of dimethocaine[27] describe effects similar to those caused by cocaine, including stimulation and talkativeness; however domethocaine was described as producing less euphoric effects at similar doses. Although little is known about the adverse effects of dimethocaine, its use appears to have become particularly problematic among intravenous drug users in this country (Ana Liffey Drug Project, personal communication). Research undertaken as part of the current review suggests that the use of 'Amplified', or 'Amplifier', which has been shown to contain dimethocaine (Kavanagh *et al.*, 2010b, 2010c, 2010d, 2010f), may be associated with a range of adverse health effects; these include increased numbers of abscesses and ulcers, anxiety, agitation, convulsions, and psychoses. Polydrug use involving 'Amplified' or 'Amplifier' has also been reported. Findings relating to the use of 'Amplified' or 'Amplifier' must be interpreted with caution. Further discussion of this issue is set out below.

As dimethocaine has anaesthetic properties, it is considered a medicinal product, and therefore marketing of this substance must be authorised by the Irish Medicines Board.

Fluorotropacocaine

Fluorotropacocaine was first reported to the EMCDDA in 2008 and is the first synthetic drug to be based on cocaine (King, 2009)[28]. Similarly to naphyrone, fluorotropacocaine replaced mephedrone as a legal alternative stimulant in Ireland after the May 2010 Order. It has been identified in 'Star Dust' (Kavanagh *et al.*, 2010b, 2010c, 2010d) and it has been found combined with desoxypipradol in 'Whack' by Kavanagh and colleagues (2010d) and also in the current review. No published data are available concerning the psychological or behavioural effects of fluorotropacocaine on users. However, in June 2010 the National Poisons Information Centre received 40 reports of adverse reactions to the product 'Whack', which is likely to have contained fluorotropacocaine combined with desoxypipradol. Reported reactions to 'Whack' included increased heart rate, increased breathing rate, raised blood pressure and anxiety (Health Service Executive, 2010). In addition, psychosis was observed among seven individuals. These reports may indicate a particular difficulty with the combination of desoxypipradol and fluorotropacocaine, although no conclusions can be reached. Desoxypipradol is known to have a longer elimination half-life than many other substances, and so it is possible that associated effects will last longer, thus increasing the possibility of adverse reactions and subsequent reports from users. Desoxypipradol is discussed further below.

As with dimethocaine, fluorotropacocaine is considered to have medicinal properties and, as such, its use is governed by the Irish Medicines Board Act, 1995.

27 For example, see *www.drugs-forum.com*.

28 The chemical structures of both are described in Section 1 of this report.

Desoxypipradol [desoxypipradrol/2-diphenylmethylpiperidine (2-DPMP)]

Although developed in the 1950s, desoxypipradol has recently emerged as a substance for recreational use. Desoxypipradol is a type of pipiradine, similar in structure to pipradrol and methylphenidate (e.g. 'Concerta', 'Ritalin'). All three are stimulants, functioning as norepinephrine-dopamine reuptake inhibitors (Ferris and Tang, 1979). Originally developed as a potential treatment for ADHD and narcolepsy, the use of desoxypipradol in reducing recovery time from anaesthesia was also explored (Bellucci, 1955). Desoxypipradol may therefore have effects similar to amphetamines, and, as a dopamine re-uptake inhibitor, it may have similar action to cocaine. Desoxypipradol has a longer elimination half-life than cocaine, and thus has a longer duration of action. As a result, it is likely that any effects will be experienced for longer and this may be a factor implicated in reports of adverse reactions to products containing desoxypipradol (e.g. 'Whack'). Published data relating to the effects of desoxypipradol in humans are scarce.

One study demonstrated effects of desoxypipradol on circulation and blood pressure (Drassdo and Schmidt, 1956). With administration of the drug in dosage of one to two milligrams, a dimunition of circulation time was observed. This was followed by a decrease in blood pressure amplitude for half of cases, followed by a 'relative increase' in blood pressure amplitude. A number of people experienced a drop in blood pressure. Increased performance on mental ability tests was observed after doses of one to two milligrams (Drassdo and Schmidt, 1956). At doses of three milligrams or more, headaches, nausea and palpitations were reported (Drassdo and Schmidt, 1956).

The recreational use of diphenylprolinol (diphenyl-2-pyrrolidinemethanol [D2PM]) another norepinephrine-dopamine reuptake inhibitor, has been observed in the UK (Lidder, Dargan, Sexton, Button, Ramsey, Holt and Wood, 2008; Wood, Button, Lidder, Ovaska, Ramsey, Holt and Dargan, 2008). A case report noted that this substance, combined with glaucine in a product called 'Head Candy', was associated with cardiovascular toxicity in a male presenting with no risk factors for ischemic heart disease (Lidder *et al.*, 2008; Wood *et al.*, 2008). Diphenylprolinol has not been identified in any product available in Ireland.

Aminoindans

2-Aminoindan (2-Ai) has been identified in 'Pink Champagnes' party pills purchased in this country (Kavanagh *et al.*, 2010a); however its use appears to be rare. Little is known about the recreational use of 2-Ai. No product tested for the current review was found to contain this substance. However, two respondents to the online survey reported having tried the substance and four reported trying 'Pink Champagnes'. 2-Ai is reportedly a short-acting stimulant with effects that have been compared with those of 1-benzylpiperazine (BZP) or methamphetamine (Long, 2010). There appears to be no published information on the use or effects of 2-Ai in humans but, as a stimulant, its action is likely to have effects on the heart and on blood pressure.

The use of another aminoindan, 5-iAi (5-iodo-2-aminoindan), was reported by survey respondents in the current study, but was not discovered in the chemical analysis of products undertaken for the review, or in analyses undertaken by Kavanagh and colleagues. Although little is known about 5-iAi, one study on rats found that it decreased 5-HT levels slightly, but significantly, and concluded that it did not appear to lead to significant deficits in serotonin (Nichols, Johnson and Oberlender,1991).

MDAI (5,6-Methylenedioxy-2-aminoindane) is an analogue of MDMA and is believed to have entactogen[29] effects. Although this substance has not been identified in the analysis of head shop products for this review, or by Kavanagh and colleagues, its use was reported among five survey respondents in the current study. MDAI has been used in scientific research as it is reported to have similar effects to MDMA, but with lower neurotoxicity (e.g. Johnson, Huang and Nichols, 1991). There does not appear to be any published data about its recreational use. Effects are likely to be amphetamine-like. however, due to the chemical structure of MDAI, it is believed to be less stimulant-like and more of an entactogen than MDMA (Johnson, Huang and Nichols, 1991). Although MDAI appears to be on sale on many websites, a recent study (Brandt *et al.*, 2010) found no MDAI in products purchased online. The availability of this substance thus appears to be limited.

Ethcathinone (ethylpropion, N-ethylcathinone, 2-ethylaminopropiophenone)

Ethcathinone is a stimulant substance belonging to the phenethylamine, amphetamine and cathinone chemical classes. Ethcathinone has been identified in the products 'White Columbia' and '100% Pure' (Kavanagh *et al.*, 2010b, 2010c, 2010d) and in 'White Columbia' in the present study. As with other new psychoactive substances, the availability of data regarding ethcathinone is limited. As a stimulant, short-term effects are likely to be similar to other stimulants, such as cocaine and ecstasy.

Ethcathinone is produced in the body through the metabolism of diethylcathinone[30], an amphetamine-like stimulant drug. Diethylcathinone itself appears to be inactive until it is metabolised into ethcathinone in the body; as a result, ethcathinone is likely to be responsible for effects associated with diethylcathinone (Rothman and Baumann, 2006). Diethylcathinone has been used for approximately 50 years as an appetite suppressant in the treatment of obesity and also as an 'off-label'[31] treatment for migraine (Santamaría and Arias, 2010). While little is known about the effects of direct administration of ethcathinone, a number of studies have addressed effects of diethylpropion.

In one study, Cercato, Roizenblatt, Lenança, Segal, Filho, Mancini and Halpern (2009) evaluated the efficacy of long-term use of diethylpropion, focusing on cardiovascular and psychiatric effects. Cercato and colleagues did not identify any cardiovascular or psychiatric risk in a carefully selected population using a randomised double-blind placebo-controlled study. Adverse side effects reported were considered mild and moderate, and were predominantly dry mouth and insomnia. No cases of abuse or dependence were detected in the study. The authors noted that cases of diethlypropion abuse identified in the literature typically involved subjects with previous psychiatric diagnoses. As such, the authors cautioned against prescription of this drug to those with a previous psychiatric disorder or history of substance abuse.
A further study (Garcia-Mijares, Bernardes, and Silva, 2009) suggested that at low doses, diethylpropion has psychostimulant and rewarding properties. As a drug's reward potential is linked to its abuse potential, the authors caution about the use of this drug in the absence of further research.

29 Nichols (1986) used the term *entactogen* to describe a class of psychoactive substances (e.g. MDMA) which produces effects of enhanced empathy and amplified emotion that are distinct from the effects of hallucinogens and amphetamines.

30 Diethylcathinome is also known as amfepramone and diethlypropion (ACMD, 2010a).

31 The use of a pharmaceutical 'off-label' refers to its use as a treatment for a condition other than that for which it has been approved.

Dimethylcathinone (Metamfepramone, dimethylpropion)

Like ethcathinone, dimethylcathinone is a stimulant substance belonging to the phenethylamine, amphetamine and cathinone chemical classes. Dimethylcathinone was identified in the product 'BluE' by Kavanagh and colleagues (2010d) and in 'BluE' and '100% Pure' in the present study. As with other new psychoactive substances, little published data appear to exist in relation to the effects of recreational use of dimethylcathinone in humans. Dimethylcathinone was once marketed as a recreational drug in Israel, but its use was banned in 2006 (Siegel-Itzkovich, 2006). The substance has also been used in cold remedies and in treating hypotension (Thevis, *et al.*, 2009).

Although little is known about the effects of newly emerged recreational cathinones, such as ethcatninone and dimethylcathinone, the effects of other cathinones, such as mephedrone and methylone have been documented (e.g. AMCD, 2010). While there may be an expectation that similar effects might exist across different types of cathinones, it is not safe to assume that one cathinone will behave the same as another, or that the effects of one will be comparable with the effects of another. Dal Cason, Young and Glennon (1997) note that while parallels have been identified between structure-activity relationships of amphetamine analogues and some cathinone analogues, amphetamine structure-activity relationships cannot necessarily be extrapolated to all cathinone analogues. They conclude as follows:

> 'It is suggested that caution be used in attempting to draw conclusions or make predictions about the activity and potency of novel cathinone analogs by analogy to the structure-activity relationships derived from amphetamine-related agents; it would appear that each new cathinone analog will require individual investigation' (p 1109).

Discussion

The nature of the 'research chemical' market means that hidden subgroups of curious individuals effectively 'test drive' substances, without prior knowledge of their potential toxicity or effects. The dynamic nature of the market, and the invisibility of its customers, present unique challenges for those attempting to identify and respond in a timely way to specific risks to individuals' health or to public health. In the absence of rigorous data collection mechanisms and published data, there may be reliance on subjective accounts of users, such as those posted on forums, and on anecdotal accounts from those who encounter such drugs. While this can generate valuable insights, and has a particular value in terms of identifying new substances as they emerge, data of this kind must be interpreted and used with caution. However, as can be seen, often there is little else to go on until a substance increases in popularity and longevity, as was the case with mephedrone and BZP.

Structure-activity relationships do not appear to be a reliable means of predicting effects, and so each new compound must be considered unique in its action and effects, until evidence indicates otherwise. While it is extremely difficult to link specific effects with individual substances, knowledge of the type of substance involved (e.g. stimulant, sedative, or hallucinogenic) may give some indication of the characteristic short-term effects that might be expected. However, a range of other factors, such as polydrug use, may complicate the picture. It is less difficult to identify effects resulting from specific practices (such as injecting) that are associated with the use of new psychoactive substances among subsets of users.

A standardised system of recording and reporting intoxications would enhance the potential to understand and respond to risks associated with new psychoactive substances. The availability of reference standards and suitably equipped laboratories would facilitate this. With any new psychoactive substance that emerges and grows in popularity, research must be undertaken to gain insight into its action and effects, in addition to its use in the population and the factors associated with its use. Such an understanding will enable the tailoring of interventions aimed at lessening negative impacts associated with the use of new psychoactive substances.

3.2 The use of new psychoactive substances

Research has typically focused on the use of one type of substance, such as mephedrone (e.g. Newcombe, 2009) or BZP (e.g. Butler and Sheridan, 2007; Wilkins, Sweetsur and Girling, 2008). Because the use of new psychoactive substances has only recently emerged as a social and cultural phenomenon, the inclusion of this issue in national surveys has only just begun. The 2010/2011 General Population Survey being undertaken by the NACD addresses the use of new psychoactive substances sold in head shops and online in the Irish context. The current British Crime Survey (2010) has also been collecting data specifically on the use of mephedrone. A number of existing studies provide insight into the use of new psychoactive substances internationally and are reviewed below. Insight into the use of mephedrone and BZP can inform understanding of the use of similar new psychoactive substances.

3.2.1 International findings

An online survey of the club-going population in the United Kingdom (UK) found mephedrone to be the fourth most popular drug among its 2,220 respondents, with 42% reporting lifetime prevalence of use; 34% reporting past month use; and 6% reporting daily use (Mixmag, 2010). Respondents were mostly male (65%), employed (81%) and aged between 18 and 27 years. The preferred routes of administration were snorting (70%) and orally (30%). Common quantities consumed were between one half and one gram in a session. Mephedrone was typically described as a cross between ecstasy and cocaine, and was commonly combined with cannabis, ecstasy and cocaine. Effects reported included: excessive sweating (67%), headaches (51%); palpitations (43%); nausea (27%); cold or blue fingers (15%); increased sex drive (60%). Almost 30% had tried *Salvia divinorum*. Although this survey involved a self-selected sample, it does provide a valuable insight into the pattern of use of mephedrone in the UK and its effects.

The Mixmag survey data is complemented by qualitative research exploring mephedrone use (e.g. Measham, Moore, Newcomb and Welsh, 2010; Newcomb, 2009). Participants in Newcomb's (2009) study reported a range of effects, including nosebleeds, dilated pupils, blurred vision, dry mouth/thirst, hot flushes, fast/erratic heart beats, muscular tension, and shrunken genitalia in men. Come-downs were reported as involving fatigue, dizziness and low mood. While few participants reported harmful consequences, there were some reports of cravings and withdrawal symptoms. A few participants reported feeling dependent. Motivations for using mephedrone included curiosity, liking the effects and having nothing else to do. Subsequent qualitative research in the UK identified availability and purity as factors implicated in the popularity of mephedrone (Measham *et al.*, 2010). Research has yet to evaluate the impact of the mephedrone ban on drug consumption choices and patterns of use.

The popularity of BZP in New Zealand led to a number of studies on the use of this substance and its effects. In one study, Butler and Sheridan (2007) conducted interviews and group discussions with young people who had used BZP party pills. The young people were using these pills mostly at weekends, in social settings associated with party/dance culture. Party pills were taken in combination with other 'legal' and illegal highs, especially cannabis and ecstasy. Reported effects included nausea, headaches, vomiting, dehydration, racing heart and an inability to urinate. Come-down effects included insomnia, loss of appetite, tension, depression and anxiety. Wilkins, Sweetsur and Girling (2008) conducted a national household survey to investigate the relationship between adverse side effects and BZP/TFMPP party pill use, and concurrent use of other drugs. They found that being female, combining cannabis and other drugs with BZP/TFMPP pills, using large amounts of party pills in one session and taking 5-hydroxytrypophan (5-HTP) 'recovery' pills were independent predictors of having experienced negative effects from BZP/TFMPP party pills (Wilkins *et al.*, 2008). Findings suggest that risky use of party pills (e.g. polydrug use) is common.

3.2.2 The use of new psychoactive substances in Ireland

The nature, extent and impact of the recently emerged and dynamic 'legal' drugs market in Ireland is a phenomenon that has yet to be quantified. Prevalence estimates of the use of new psychoactive substances among the Irish population are not yet available. Within the EU, Ireland has the third highest lifetime prevalence of ecstasy use in the general population: 5.6% among 15 to 64 year olds and 9% among 15 to 34 year olds (EMCDDA, 2009). Similarly, Ireland has the fourth highest lifetime prevalence of cocaine use within the EU: 5.3% among 15 to 64 year olds and 8.2% among 15 to 34 year olds (EMCDDA, 2009).

Despite the dearth of information in relation to the use of new psychoactive substances in Ireland, one survey undertaken by the NACD in 2008 gives an estimate of party pill use among early school leavers and school attendees aged 16 to 18 years (Haase and Pratschke, 2010). The survey revealed that 23.4% of 479 early school leavers had used 'legal high' party pills in their lifetime; 13.2% had used them in the previous year; and 2.9% in the previous month. Among 512 school attendees, 6.8% had used 'legal high' party pills in their lifetime; 3.9% in the previous year; and 0.2% in the month prior to the survey. Hasse and Pratschke (2010) identified ease of access to cannabis and other drugs (excluding tobacco) as a risk factor for increased consumption of substances. Until very recently, research specifically addressing the use of new psychoactive substances in the Irish context was lacking, and much of what had been undertaken had addressed the issue of new psychoactive substance use among problem drug users (McNamara, Stokes and Coleman, 2010; Murphy, McCarthy, Harkin and Keenan, 2010; O'Reilly, McAuliffe and Long, 2010).

New psychoactive substances use among problem drug users

A number of recent studies have investigated the issue of new psychoactive substances use among the problem drug-using population in Ireland. One study, which was conducted prior to the Government Order in May 2010, investigated the extent of use of mephedrone, methylone and BZP among a group of individuals attending a methadone maintenance programme (McNamara *et al.*, 2010). In total, 209 urine samples were tested in a group of attendees selected through a mix of purposive and random sampling. Results demonstrated that 13.9% (29) of samples tested positive for mephedrone; 3.3% (seven) for methylone; and 0.5% (one) for BZP, thus indicating that more than one in ten of those tested were using 'legal high' powders. Prior to the control of BZP, 7.5% of urine samples tested positive for the substance (McNamara, 2009) and, following control, this reduced to 0.5%.

The use of new psychoactive substances among homeless problem drug users has also been highlighted. In one study, drug users attending a drugs service in Dublin city were surveyed about their use of new psychoactive substances in powder form (Murphy *et al.*, 2010). Of the 17 individuals surveyed, 12 (70.6%) had tried 'bath salts' on at least one occasion. Products sampled included 'Snow' (84% [ten]); 'Blow' (42% [five]), and 'Vanilla Sky' (25% [three]), and 50% of the respondents had injected these. Desired effects were described as similar to ecstasy, cocaine or methamphetamine. Unwanted effects reported included difficulty sleeping, anxiety, agitation, hallucinations and paranoia. Come-down effects included agitation, depression and paranoia. Findings thus indicated a high level of use of new psychoactive substances in powder form among this homeless drug-using sample. Associated negative effects on mental health were also reported.

Qualitative research exploring the use of new psychoactive substances involved a focus group undertaken with a group of ten problematic drug users (O'Reilly *et al.*, 2010). The researchers also conducted interviews with three homeless polydrug users living in a hostel and one recreational user who had a history of cocaine use. The range of products sampled by participants included 'Blow', 'Blow Out', 'Charge', 'Hurricane Charlie', 'Snow', 'Vanilla Sky' and 'Wild Cat'. Focus group participants injected these powders and reported effects as being stimulant-like. Most participants reported an immediate and intense 'buzz' lasting for approximately 20 to 30 minutes, followed by a longer, less intense effect. Increased energy, euphoria, relaxation and talkativeness were reported. Come-down effects were reported to vary and included low

mood, irritability, depression and suicidal thoughts. Of the three participants who used heroin, none reported a reduction in their use of heroin as a result of using new psychoactive substances; one reported using heroin to ease the come-down of such substances; and one used these substances to cope with withdrawal from heroin. The accounts of one of the four participants indicated compulsive use and possible dependence on new psychoactive substances in powder form.

The research findings outlined indicate that powders containing new psychoactive substances are being used by problematic drug users and that injection tends to be the preferred route of administration. Among this group, stimulant-like effects may be followed by a range of negative physiological effects, notably insomnia, and negative psychological effects such as low mood, depression, anxiety, agitation, and paranoia. Service providers' observations have supported these findings.

From the available evidence, the impact of the use of powders containing new psychoactive substances on heroin use does not appear to involve a reduction. Instead, it appears that a pattern of use may have emerged that involves heroin and powders being used interchangeably, with one being used to cope with the negative effects of the other. The extent and implications of this pattern of use have yet to be fully understood.

New psychoactive substance use among non-problem drug users

Much of what is known about the use of new psychoactive substances in Ireland among non-problem users comes from recent qualitative research. Van Hout and Brennan (in press, b) interviewed 33 young people (aged 18 to 33 years) about their use of 'legal highs' prior to the May 2010 Order. A range of new psychoactive substances, including powders and party pills, cannabis substitutes and ethnobotanicals, such as 'Hawaiian Baby Woodrose' and mushrooms had been sampled by participants. Effects experienced were described as both similar and different to illegal alternatives. Few participants heeded instructions on packaging, and cautious dosing was practised more often by older, more experienced users than by younger, less experienced ones. In addition, almost all participants engaged in polydrug use, particularly involving cannabis, ecstasy and cocaine. Young people reported sourcing new psychoactive substances from head shops and friends, and the use of these substances was associated with social gatherings such as parties and festivals.

Similar to findings from the UK (Mixmag, 2010), mephedrone was identified as the 'drug of choice' among this group, both prior to and following the May 2010 Order (Van Hout and Brennan, in press, a, b). Typical quantities ingested were one half to two grams in a session. Reported effects included feelings of elation, feelings of love, and quickened heart rhythms. As with previous studies (e.g. Mixmag, 2010), heightened sexual desire/drive was reported with mephedrone. Less desirable effects included 'nose-burn' (from snorting) and an unpleasant acidic/chemical taste. A minority of participants experienced come-down effects which included anxiety, depression and physiological withdrawal symptoms. For the majority, the mephedrone experience was described as positive and come-down effects were considered less problematic than for illegal drugs. Among those interviewed, factors influencing use of new psychoactive substances included availability, curiosity, perceived safety and inferior quality street drugs (Van Hout and Brennan, in press, b).

A recent survey of head shop product use (The Dales Centre, 2010) found that 76 (81%) of 94 people surveyed had used head shop products; among those users, party pills were the most popular. Twelve respondents had used *Salvia divinorum* and eight of these were under 18 years of age. Reported side effects of the substances tried included insomnia, thirst and dry mouth, and mood swings; 15 people reported that the effects lasted for more than three days. One person reported suicide ideation as a result of their use of head shop products and one person sought emergency medical attention.

3.3 The current study: the experience of problem drug users

The current study was aimed at gaining further insight into the use and effects of new psychoactive substances among problem drug users.

Brief interviews were carried out with five injecting drug users who were attending a drugs project in Dublin city. All were male and all volunteered to participate in the interviews. In addition to these interviews, the views of two project workers in a Dublin north city drugs project were elicited in order to gain further insight into the use of new psychoactive substances among this group. Many of the clients in this drugs project were described as being at 'crisis' stage in terms of using new psychoactive substances in powder form. Data are also incorporated from a service user peer group discussion in relation to the use of head shop drugs (notably 'Snow', 'Amplified' and 'Wild Cat') which was undertaken by a north city service (Ana Liffey Drugs Project, personal communication).

Four of the participants had long histories (up to 20 years) of intravenous heroin use, and were polydrug users. Participants had varying experiences with new psychoactive substances: four participants had at some point engaged in regular or daily use of powders and one had used a powder on one occasion only.

Products used

The four participants with a history of frequent use of powders containing new psychoactive substances each reported trying 'all' of the powders that have been available on the market since head shops first opened. These powders included 'Snow', 'Snow Blow', 'Mind Melt' and 'Wild Cat'. Current use (July 2010) of 'White Columbia', '100% Pure', 'Ivory Wave' and 'Amplified' was reported by participants, and current use of 'Hurricane Charlie' was reported by project workers. In particular, participants made reference to 'Amplified' and 'Amplifier'. Whereas they appeared to be referring to the same product, it was unclear to what extent the name 'Amplifier' had been adopted among this group as a generic name for new psychoactive substance powders. While the clients interviewed appeared to be discerning in relation to the powders they used, reports from service providers cited instances where the name 'Amplifier' was used as a generic term, in much the same way as the term 'mephedrone' was used before the May 2010 Order. Despite this, a packet of'Amplifier' was displayed to the researcher during an informal conversation with a client and this was indeed a packet of 'Amplified'[32] , as presented on the identification charts (Kavanagh *et al.*, 2010b, 2010c, 2010d, 2010f). As is the case with all named products or substances, caution must thus be exercised in interpreting references to 'Amplified' and 'Amplifier'.

Desirable effects

Consistent with previous studies (Murphy *et al.*, 2010; O'Reilly *et al.*, 2010), powders used were reported to have stimulant-like effects, mimicking cocaine, ecstasy and metamphetamine. One participant noted that 'some just have a head rush and some are the same as coke'. 'White Colombia', which is reportedly an ethcathinone product, was this client's 'favourite' powder and he described the effects as being 'just like coke' and 'better than coke – it has a better buzz'. In terms of the duration of effects, he stated that it lasts for the same duration as cocaine: 'a few hours'.

The 'buzz' or 'rush' from 'Amplifier' was described as a methamphetamine-type buzz, which is very short in duration. One client who reported current daily use of 'Amplifier' described it as follows:

> 'Amplifier' has a great rush, a crazy rush …a two or three minutes [rush], but really longer – you feel quite tired and stoned for an hour or so … It's sort of like crack. Better than coke. A great buzz. [13]

32 Post-ban analysis of the product 'Amplified' revealed the presence of dimethocaine (Kavanagh *et al.*, 2010).

'Amplifier' and 'Amplified' are typically reported as being similar in duration and effect to cocaine, but 'better' than cocaine. The strength of the substance was emphasised by three of the four clients who had used it. According to one:

> 'Amplified' is one of the strongest drugs I have ever taken in my life. It only lasts six minutes – like really, really good coke [better than] … Ketamine is the only thing like it [as strong as it]. It was so strong, it was unbelievable. [14]

The transient nature of the 'buzz' was emphasised. This was reflected in accounts of project workers, who reported that clients are typically not presenting while 'high' on 'Amplifier', but rather in the aftermath of the 'buzz'. One client contrasted the 'buzz' from 'Amplified' to that from 'Wild Cat', which he prefers:

> I got a head rush, then it disappeared … You'd need to be buying bags of it ['Amplified'] to get a good time out of it. I prefer 'Wild Cat' – it's a good long rush – there's a better balance. [14]

Participants emphasised the consistency of effects of the powders across use. In relation to 'Amplified', one commented as follows:

> 'It's very consistent, very well measured. There's very good quality control. Professionally made' [14].

Reports of consistency are in contrast to recreational user accounts in online forums, which highlight the evolving nature of substances and changes in effects over time (O'Reilly *et al.*, 2010).

Quantity, mode and frequency of use

Injection is the preferred route for the administration of new psychoactive substance powders among the group interviewed. One client also reported smoking the powders in a pipe, in the same manner as that used for smoking crack cocaine. Project workers' reports identified the use of 'Amplifier' in rock form smoked in a crack pipe, or injected, and also in tablet form, crushed before use. As the substance is soluble in water and is believed to have fewer impurities, citric acid is typically not reported as necessary in 'cooking' the substance prior to use.

Project workers reported that clients are injecting up to one gram of 'Amplifier' at a time. This was reflected in the personal accounts of the clients interviewed. One had injected one gram of 'Amplifier' daily for four weeks. Another reported current daily use of 'Amplifier' in half-gram 'turns', which he injects. This client claimed that if he had the money to do so, he would use between five and ten grams of 'Amplifier' a day. As the desirable effects of 'Amplifier' are short-lived, clients are using the substance again within an hour or so. It is also common for them to mix 'Amplifier' with heroin or to take a 'turn' on heroin in the aftermath of the 'buzz' from 'Amplifier' or other powders. One client stated that he would typically take 'half an eight' (approximately 1.5 grams) of 'White Columbia' and that this would be used alongside two grams of heroin over one session:

> Three half grams [of 'White Colombia'] and two grams of heroin in eight hours. That's mad. It's a lot to take – you're able to take a lot. [11]

As was observed in a previous study (O'Reilly *et al.*, 2010), there is some indication of tolerance and dependence with 'Amplifier' contained in the personal accounts of drug use given by participants in the current study. Notably, Participant Three, who was injecting daily in half-gram turns, referred to his 'habit' and increasing dosage:

> I used to take two turns off one half gram, but as the habit got bigger and bigger … [I took more and more]. [13]

Participant Two, who had been a daily injector of 'Amplifier', observed that tolerance to the product develops in the same way as with heroin or cocaine, and that there is an addictive quality, which he believes is more psychological than physical.

Unwanted effects

In contrast to the come-down from mephedrone, during which clients were described as depressed and emotional, the come-down from 'Amplifier' was described by project workers as involving prolonged hallucinations and paranoia. Users of the substance described the come-down from 'Amplifier' as severe and involving depression and agitation. As was observed previously (O'Reilly *et al.*, 2010), clients are likely to use more 'Amplifier', to take a 'turn' on heroin, or to use benzodiazepines during the come-down phase. Participant Three was using 'Amplifier' daily and described the come-down as follows:

> Kinda depressing, until I use something else – heroin, or more 'Amplifier'. [13]

From the project workers' observations, short-term effects (in the days following use) of 'Amplifier' included visual and aural hallucinations and paranoia. Typical visual hallucinations involved being chased or followed, or being covered in insects, mice or rats. One participant reported visual distortions resulting from injecting half a gram of 'Amplified', which involved the perception of there being 'a green tinge to everything'. Effects reported by peer group participants included memory loss, paranoia, depression, suicidal thoughts and loss of awareness (Ana Liffey Drugs Project, personal communication).

According to the project workers, negative effects are not taking a long time to occur, but tend to occur after relatively short-term use of 'Amplifier'. This observation was reflected by one participant who had used 'Amplifier' daily for four weeks. The client felt his long history of drug use enabled him to quickly perceive the negative effects resulting from his use of 'Amplifier' and, as a result, he ceased using it. He commented:

> I stopped. I copped the effects – I've been around a bit longer than others… dramatic weight loss, ten times quicker than coke or speed. You also become aggressive and agitated. [12]

Similarly, changes in temperament and behaviour have been observed by the project workers. In particular, paranoia and volatility were reported, and this paranoia often involves people on the street and in the client's environment.

There appears to be a particular vulnerability to negative psychological effects among those with existing mental health issues. Three clients who had been managing a diagnosis of schizophrenia experienced a rapid deterioration resulting in attempted suicide: two following two months' use and one following one month's use of 'Amplifier'. One participant also commented that he had 'witnessed a lot of people having breakdowns' [13] as a result of using 'Amplifier'. Clients were also reportedly more likely to engage in risky criminal behaviour, such as doing 'jump-overs'[33] unmasked.

Physiological effects on clients observed by project workers included a loss of motor skills, loss of control of limbs, an inability to talk, and twitching. As was the case with Participant Two, project workers reported marked and rapid weight loss among those using 'Amplifier'. In addition to weight loss and aggression, Participant Two reported abscesses and ulcers at injection sites. Swelling at injection sites and an increased number of abscesses and ulcers among clients injecting 'Amplifier' were also observed by project workers. Bigger gauge needles were being used because the substances tended to clog in the needle; in addition, veins were rendered unusable in a short space of time (days). Physiological effects reported by peer group participants included involuntary muscle spasms, temporary blindness, insomnia, echoing sounds in the ear, excessive energy, a feeling of falling and a feeling of potentially swallowing one's tongue (Ana Liffey Drugs Project, personal communication).

33 A 'jump-over' is an attempt at robbery that involves jumping over the counter in a retail outlet.

As is the case with heroin, it seems to be common for clients to engage in compulsive re-dosing with 'Amplifer'. Due to the compulsive quality of the substance, individuals were found to be injecting more frequently and were also injecting into wounds which previously they would have allowed to settle. Such practices create added risks. Project workers described one long-term client who has a long injecting career and good injecting practices but who was 'riddled with ulcers'; it is unlikely that this would have happened if clean 'works' were being used. One project worker concluded that:

> It's not their practice that has changed, it has to be something in the substance – there is a direct correlation between the substance and the difficulties observed.

The proposed link between substances and specific difficulties with injecting were similarly noted by Participant Four in relation to 'Snow'. This participant had a twenty-year history of drug use and had been injecting new psychoactive substances in powder form since they first became available. He differentiated between those powders that you can 'miss' with (miss the vein) and those that you cannot miss. In relation to 'Snow', he noted the change in this product over time. For him, there were two types of product: the 'older' and the 'newer'. With regard to the 'older' 'Snow' he commented as follows:

> If injecting, you had to get it straight into the vein or else it would burn and would eat through your vein like acid. [14]

Indeed, this participant had a scar on his thumb which he reported as a hole burned from injecting 'Snow' at this site. This difficulty, he felt, was not present with 'newer' 'Snow'. When compared with 'Snow', he described 'Wild Cat' as 'very good':

> I'd inject half a gram at a time. Twenty quid a shot. You could miss with 'Wild Cat' and it would still be absorbed. With 'Snow' you'd be screaming – like banging bi-carbonate of soda by mistake. [14]

A burning sensation in the veins was also reported by peer group participants, even when citric acid was not used. Similar to Participant Four, information from the peer group discussion indicated a lack of consistency observed by users of head shop products. A product 'cooked' on one occasion presented as watery in the barrel, yet the same product 'cooked' on another occasion presented as crystallised. In both instances, the 'cooked' product had remained in the barrel for a length of time.

According to project workers, collapse and convulsion have been observed more frequently in those using 'Amplifier', and particularly so in the month leading up to the interviews (May-June 2010). Participant Three gave an account of one such incident that occurred the day before the interview. He reported:

> I was with a girl yesterday and she had a massive fit using 'Amplifier'. We had half a gram each [injected]. I got her an ambulance … She managed to regain consciousness. [13]

Participant Three did not report personally experiencing negative effects from using 'Amplifier' beyond the come-down, but he did contrast this with the effects experienced having used 'Blow'. When using 'Blow' daily, he described 'tripping-up' and having poor co-ordination. He described 'Blow' as being more addictive than 'Amplifier'. In addition, he observed a person he knew breaking down psychologically from daily use of 'Blow'. He commented:

> It was very frightening, so I went back to the heroin. [13]

In contrast with the other participants, Participant One did not feel that there are any negative effects attached to his use of 'White Columbia' (or other powders), although he did state that insomnia is a feature to be expected. For him, the insomnia persists no matter what other substances he ingests, and he reportedly ingests 'everything' which includes 'tablets' (benzodiazapines), new psychoactive substance powders and heroin. When asked about the come-down, he commented:

> There's no come-down, you're just awake and that's it. It's not like E where you'd be depressed. [11]

The fifth participant had used a new psychoactive substance in powder form just once. On this occasion he injected one gram of 'Snow Blow', which resulted in a 'bad trip'.

> Everything was going real fast; palpitations, heart beating. I thought I was going to die. It was frightening. Everything was coming at me fast. There was a sound like an echo. [15]

The experience lasted approximately 20 minutes and affected the participant so much that he had not used a new psychoactive substance powder since the event, which occurred eight months before the interview.

As outlined above, the negative effects experienced as a result of using 'Amplifier' led one participant to discontinue use. However, among the remaining three participants, the effects were generally considered to be worth it. Nonetheless, there appeared to be an awareness among the non-daily users that frequency and duration of use were factors to be considered. Participant Four had been using such powders two or three times a week for 'a couple of months'. In relation to this pattern of use, he commented:

> You couldn't keep it up. I'm 20 years doing drugs and I know you couldn't keep *that* up. [14]

Similarly, Participant One who had been using powders 'once or twice a week since the hemp shop opened' commented:

> It would send you off your brain if you did it every day. [11]

Finally, participants reported typically obtaining powders from head shops, and one had been purchasing 'Amplifier' on the street. One participant was spending all his 'Labour' (social welfare payment of approximately €200 a week) on powders, and another had previously also done so. Of the remaining two participants who were continuing to use such powders, one reported spending about €100 a week and the other had spent €75 on the day before the interview.

Discussion

Injecting drug users constitute an especially vulnerable sub-population among users of new psychoactive substances. The data gathered from this group and from project workers engaged with them appear to converge, and are consistent with previous research (Murphy *et al.*, 2010; O'Reilly *et al.*, 2010). This group appears to be using new psychoactive substances in powder form, in particular 'Amplifier', with more frequency and in larger quantities than are other users. In addition to this, their preferred route of administration (injection) is associated with unique and specific risks and complications.

Polydrug use among injecting drug users is common, with reports of individuals mixing 'Amplifier' with heroin in a 'turn'. The use of heroin does not appear to have reduced among this group, but instead seems to have changed in pattern. In addition to mixing heroin with new psychoactive substances in powder form, individuals reported using other substances, notably heroin and benzodiazepines, to stave-off come-down effects of such powders. Frequently, the come-down phase is not even reached as it appears the nature of the many new psychoactive substances used means that compulsive-re-dosing is common. Previous research also notes the use of these substances to cope with withdrawal effects from heroin (O'Reilly *et al.*, 2010).

Project workers reported specific psychological effects among users, and these are corroborated in the accounts of users themselves and by previous research (Murphy *et al.*, 2010; O'Reilly *et al.*, 2010). All participants had either experienced difficulties themselves, or had observed others experiencing negative psychological effects attributed to the use of new psychoactive substance powders. Thus, it was common for user participants to note dangers associated with the use of these substances, and this appears to have led to changes in patterns of use for most of the participants. It appears that those with an existing mental health diagnosis may be especially vulnerable to the effects of 'Amplifier' and other new psychoactive substances.

Both user and project worker accounts suggested that certain properties of the substances being used render them especially problematic. It was noted that there appears to be a greater incidence of ulcers and abscesses associated with the use of these substances. From the project workers' perspectives the difficulties do not appear to be due to changes in injecting practices. Rapid and dramatic weight loss is also reported, and is considered more pronounced than that associated with other stimulants, such as cocaine.

In addition to the physical and psychological impacts of the new psychoactive substances on individual users, there are public health implications related to the use of such substances. The social functioning of users also appears to be impacted, with some users spending all of their money on these products and others spending large amounts. Previous research also describes homeless drug users losing emergency hostel accommodation as a result of the use new psychoactive substances (O'Reilly *et al.*, 2010).

The pattern of use and reported effects associated with new psychoactive substances among injecting drug users mean that targeted measures must be developed and promoted in order to ensure that the harm associated with these substances is minimised. In doing so, it must be acknowledged that the products themselves vary, and that both effects and patterns of use are also likely to vary among individuals.

3.4 The current study: new psychoactive substance use among 'recreational' users

An anonymous and confidential online survey of 'legal high'[34] users was conducted in order to gain insights into user experiences and patterns of use. The Internet has been shown to be an effective means of accessing hidden populations, such as recreational drug users (Duncan, White and Nicholson, 2003; Mixmag, 2010) and 'legal highs' users (Mixmag, 2010; Schmidt and Butler, 2009).

Methodology

Ethical clearance for the study was granted by Dublin Institute of Technology (DIT) Research Ethics Committee (June 2010). The target population was 'legal highs' users aged 16 years and over. For the purposes of the research 'legal highs' referred to the following:

- Powders, including 'bath salts', 'party powder', 'party snuff', 'plant feeder', 'Hoover freshener'
- Party pills, tablets, capsules, pellets
- Liquid highs
- Smoking blends, including 'herbal incense', 'room odouriser', 'potpourri'
- Ethnobotanicals, including psychedelic/hallucinogenic plants, seeds, mushrooms and cacti

34 As previously noted, the terms *legal high* and *legal highs* are used in this context to refer to new psychoactive substances which were available both before and after the ban (May 2010).

Instrument

The questionnaire was designed to elicit information about the kinds of 'legal highs' tried, the effects experienced and the context of 'legal high' use. Questions were constructed based on guidelines for surveys on drug use in the general population (EMCDDA, 2009) and drawing on a previous online survey of drug use (Mixmag, 2010). The survey was developed and hosted online using the Bristol Online Surveys (BOS) web application.

The questionnaire contained 51[35] questions in total, but participants could choose to answer certain questions based on the kinds of 'legal highs' (powders, pills and liquid highs, smoking blends, ethnobotanicals) that they had tried.[36] Before answering the main body of the survey questions, participants were asked to indicate their consent to participate and confirm that they were aged 16 years or over. The survey took up to 20 minutes to complete. It was piloted using guidelines for piloting online surveys recommended by Andrews, Nonnecke and Preece (2003), which in turn are based on guidelines by Dillman (2000).

Recruitment

A combination of convenience and 'snowball' sampling was used. While there are inherent biases with these methods, there are also difficulties in accessing a representative sample of a hidden population, such as new psychoactive substance users. For this reason, this sampling strategy is deemed appropriate for the purposes of the research. However, data are not representative of the general population and cannot be generalised beyond the current study.

Participants were recruited in the following ways:

- An advertisement which ran for three days in the *Irish Independent* newspaper (Friday and Saturday) and the *Sunday Independent*.
- A Facebook advertisement that linked to the research Facebook page and then to the questionnaire itself. The advertisment targeted all those aged 18 years and over in the Facebook Ireland network (1,500,000 individual profiles approximately).
- Posting of information and a link to the survey on websites, including *www.drugs.ie* and a number of regional Drugs Task Force websites.
- An 'invitation to participate' email, which was circulated to the researchers' contacts, and then circulated through these contacts as part of a 'snowball' strategy.
- An 'invitation to participate' was emailed to staff and students of DIT. Other third-level institutes were approached with view to similar action, but declined to participate. A number of students' unions nationwide agreed to advertise the questionnaire through their websites.
- Word of mouth.

Permission was not granted to post information on a number of the online forums approached (e.g. *www.boards.ie*; *www.electricpicnic.ie*; and *www.oxegen.ie*).

35 Some questions contained multiple parts.

36 Forced choice options were not used due to the sensitive nature of the topic. Instead, respondents could choose not to answer a question, if so desired. Therefore, the sample size is not consistent across the survey.

Procedure

Participants who clicked on the link to the questionnaire were presented with an information statement, and were then asked to indicate their consent to participate and their eligibility in terms of age. When respondents submitted the answer to the final question, they were presented with a debriefing statement which contained a link to *www.drugs.ie* where they could find details of support services, should they wish to access any. Respondents were also asked if they would like to volunteer to speak to the researchers in person about their experiences with 'legal highs'. After two weeks, data was downloaded for analysis. At this point, 333 respondents had completed the questionnaire. Following inspection of the data, four cases were removed: two of these had indicated their age as under 16 years, and two were deemed to be sabotaging the research, as determined by their text responses.

The online survey was complemented with brief semi-structured interviews with four new psychoactive substance users, three of whom were recruited through the online survey and one of whom was recruited through word of mouth. All participants were male; three were in their late thirties and one was in his mid twenties. All had a history of illegal drug use in addition to use of new psychoactive substances. Although the sample was small, the interview data complement the survey data and provide an insight into the use of new psychoactive substances and directions for future investigation.

3.4.1 Characteristics of users

Of the 329 respondents, 66.6% (219) were male, 32.8% (108) were female, and 0.6% (two) were transgender. There were thus approximately twice as many male respondents as female. Respondents ranged in age from 16 to 58 years. The mean age was 24.76 years (sd = 6.769) [n = 329].

The majority of respondents were residing in Ireland (97.3% [320]). Of these, 59% (194) were residing in Dublin, and the remaining 38% (126) were residing throughout the rest of Ireland [n = 329]. Respondents described the area they live in as urban (66.9% [220]); small urban (16.4% [54]); and rural (16.7% [55]) [n = 329]. Approximately half the respondents were living with their parents (51.4% [169]); while 10.3% (34) were living alone; 14% (46) were living with friends; and 17.9% (59) were living with a spouse or partner [n = 329].

Students comprised the majority of the sample, with 62.9% (207) studying at university, college, or an institute of technology, and 1.8% (six) studying at secondary school. Approximately a quarter (25.5% [84]) of the sample were working or were self-employed and 6.1% (20) of the respondents were receiving State benefit [n = 329]. Respondents' highest level of completed education is presented in Table 3.1.

Table 3.1 Highest level of completed education

Level	Percentage of respondents
Primary school	0.6% (2)
Junior Certificate or equivalent	1.8% (6)
Leaving Certificate or equivalent	39.8% (131)
Certificate or diploma	18.8% (62)
Primary degree	20.7% (68)
Postgraduate diploma	4.6% (15)
Higher degree (e.g. Masters or PhD)	13.1% (43)
N	**327**

The majority of respondents had used alcohol in the previous year (99.7%) (319) [n = 320] and most had also used alcohol before they were 18 years old (92%) (298) [n = 324]. The most common age of first alcohol use was 14 years (23.5%) (75). Tobacco use in the previous year was reported by 76% (240) of respondents [n = 316]. In addition, 84.4% had used tobacco before the age of 18, with the most common age of first use of tobacco being 15 years (16.3%) (47) [n = 288].

3.4.2 Use of new psychoactive substances in powder form

Fifty-seven per cent (186) of respondents reported having tried at least one 'legal high' powder. Of those who reported having tried a 'legal high' powder, 69% (118) had not done so on any day in the previous month; 9.9% (17) had used a 'legal high' powder on one day in the previous month; and 15.2% (26) had used 'legal high' powder(s) on two to five days [n = 171]. The majority of respondents (118) had not used a 'legal high' powder on any day in the previous month. This appears to indicate a current pattern of infrequent use of 'legal high' powders among the individuals sampled. Of those who have used powders, 34.3% (60) had not done so for any more than one day at a time [n = 175].

Respondents were asked to indicate the types of powders they had tried. Table 3.2 presents their responses. Collectively, respondents reported having tried 40 substances. Among these substances, there is some overlap between chemicals and products, as in the case of mephedrone, which has previously been the psychoactive substance in products such as 'Magic', 'Pure Gold' and 'Wild Cat'. Mephedrone was the powder reported most frequently by respondents, followed by 'Snow Blow' and then 'Wild Cat'. The actual figures for mephedrone are likely to be higher, as both 'Snow' and 'Wild Cat' formerly contained mephedrone. Chemical analysis of 'Snow Blow' indicated that it contained caffeine and no other psychoactive substance – both before and after the May 2010 Order (Kavanagh *et al.*, 2010a, 2010d). Individual respondents reported having tried between one and 11 powders (mean = 2.23). Unsurprisingly, pre-ban (May 2010) products were more commonly reported than post-ban products. Of those who had tried a 'legal high' powder, 26.3% (49) reported having used an unknown powder [n = 186].

Table 3.2 New psychoactive substances in powder form tried by respondents*

Product/substance**	Percentage of respondents
Mephedrone	66.2% (123)
'Snow Blow'	40.3% (75)
'Wild Cat'	37.6% (70)
'Charge'	30.6% (57)
'Magic'	18.3% (34)
'Blow Out'	10.8% (20)
Methylone	10% (18)
'Whack'	7.5% (14)
'Pure-NRG'	7.5% (14)
'Charlie Chalk'	7% (13)
'White Columbia'	6.5% (12)
'Star Dust'	5.9% (11)
'Rush'	5.4% (10)

Table 3.2 New psychoactive substances in powder form tried by respondents* (continued)

Product/substance**	Percentage of respondents
'Storm'	4.3% (8)
'Raz'	3.8% (7)
Flephedrone	3.8% (7)
Dimethocaine	3% (6)
Naphyrone	2.7% (5)
'Mind Melt'	2.7% (5)
MDAI	2.7% (5)
'Amplified'	2.7% (5)
'White Lady'	1.6% (3)
'Sno Berry'	1.6% (3)
'Hurricane Charlie'	1.6% (3)
'2-Ai'	1.6% (3)
'The Business'	1% (2)
'5-iAi'	1% (2)
'The Dogs Bollox'	0.5% (1)
'Snow Storm'	0.5% (1)
'Oceanic'	0.5% (1)
'Magic Mist'	0.5% (1)
Lignocaine	0.5% (1)
'Ivory Wave'	0.5% (1)
Fluorotropacocaine	0.5% (1)
'Fast Track'	0.5% (1)
'Diamond Dust'	0.5% (1)
'Pure Gold'	0.4% (8)
'Plan B'	0.2% (4)
MDPV	0% (0)
Butylone	0% (0)
n	**186**

* Multiple choice answer options were available to respondents.

** See Section 1 of this report for information regarding the psychoactive content of powders listed.

3.4.3 Route of administration of new psychoactive substances in powder form

As can be seen in Table 3.3, the most common route of administration of powders reported was snorting (85.5% [159]), and this was followed by rubbing on the gums or on the inside of the mouth (40.3% [75]). A further common route of administration was 'bombing', which involves swallowing a quantity of the powder wrapped in a cigarette paper ('skin'). Bombing may be engaged in to avoid harsh effects on the nasal passage, which may result from snorting. No survey respondent reported injecting new psychoactive substances in powder form.

Table 3.3 Route of administration of new psychoactive substances in powder form*

Route	Percentage of respondents
Snort	85.5% (159)
Bomb (swallow wrapped in a cigarette paper)	28% (52)
Rub on gums or inside of mouth	40.3% (75)
Swallowing whole	3.2% (6)
Drink mixed into beverage	15.6% (29)
Drink straight	1.1% (2)
Inject	0% (0)
Smoke in a joint/cigarette	10.8% (20)
n	**186**

* Multiple choice answer options were available to respondents. n = 186.

3.4.4 Quantity consumed

For the majority of respondents (44.9% [57]) the duration of a typical session using powders and/or party pills/'liquid highs' was 24 hours [n=127]. As can be seen in Table 3.4, approximately a quarter (25%) of respondents consume less than one half gram of 'legal high' powder in a typical session and almost one-third (33%) of respondents consume between half a gram and one gram. No respondent reported using more than three grams in a typical session. In terms of the *largest amount* of 'legal high' powder consumed in a session, 14.5% (27) of respondents reported consuming more than three grams in one session. There were three reports (1.6%) of having used more than ten grams in one session.

Table 3.4 Quantity of new psychoactive substances in powder form taken in one session

Quantity consumed	Percentage of respondents	
	Typical session	Most in one session
None	4.8% (9)	1.6% (3)
Less than 0.5 gram	25.3% (47)	9.1% (17)
Between 0.5 and 1 gram	32.8% (61)	18.3% (34)
1 gram to 1.5 grams	12.4% (23)	13.4% (25)
Between 1.5 and 2 grams	7% (13)	14% (26)
2 to 3 grams	4.3% (8)	10.2% (19)
Between 3 and 5 grams	0% (0)	8.1% (15)
5 to 7 grams	0% (0)	4.3% (8)
Between 7 and ten grams	0% (0)	0.5% (1)
More than ten grams	0% (0)	1.6% (3)
n	**163**	**151**

3.4.5 Use of party pills and 'liquid highs'

In terms of the use of party pills and 'liquid highs', 48.3% (159) of respondents reported having tried at least one type of 'legal high' party pill/'liquid high' [n = 329]. Of those who reported having tried party pills/'liquid highs', 82.3% (121) had not used any in the previous month; 12.3% (18) had used party pills/'liquid highs' on one day in the previous month; and 5.4% (eight) had used them on two days or more [n = 147]. This appears to indicate recent infrequent use of these substances among the individuals sampled. In terms of use on consecutive days, 64.6% (95) reported using party pills/'liquid highs' for a maximum duration of one day; 20.4% (30) for two days; and 15.6% (23) for more than two days in a row [n = 147].

Table 3.5 presents a list of the party pills and 'liquid highs' reportedly used by survey respondents. Respondents identified trying 52 types of party pills/'liquid highs'. However, it is likely that there is some overlap in reports between chemicals and products. For example, BZP is a piperazine, as were the products 'Charleeze', 'Doves', 'Hummer', 'Flying Angel', 'Lime Fantasy'. Although BZP was reported most often by respondents (37.1% [59]), actual figures for BZP are therefore likely to be higher than this. BZP was followed in terms of frequency of reports by 'Diablo' (23.3% [37]), and 'Exotic' (16.4% [26]). Individual respondents listed trying between one and eight types of pills/'liquid highs', with most respondents have tried just one type (46.5% [74]). Of those who have used party pills/'liquid highs', 43.4% (69) had taken an unknown party pill/'liquid high' [n= 159].

Table 3.5 Party pills/'liquid highs' tried by respondents*

Product/substance**	Percentage of respondents
BZP	37.1% (59)
'Exotic'	16.4% (26)
'Diablo"	23.3% (37)
'Mint Mania'	6.9% (11)
'Energy'	6.3% (10)
DMT	4.4% (7)
GBL/GHB	4.4% (7)
'Redd Hearts'	3.8% (6)
'Orbit'	3.1% (5)
'Blessed'	2.5% (4)
'Giggle'	2.5% (4)
mCPP	2.5% (4)
'Party On'	2.5% (4)
'Pink Champagnes'	2.5% (4)
'Pinkys'	2.5% (4)
'Rainbow Drops'	2.5% (4)
DMAA	1.9% (3)
'Dr Feelgood'	1.9% (3)
'Go-E'	1.9% (3)
'Iced Diamonds'	1.9% (3)
'Lime Fantasy'	1.9% (3)
'Pure Go-E'	1.9% (3)
'Zonk'	1.9% (3)
'Nemesis'	1.3% (2))
2-Ai	1.3% (2)
'Benzo Fury'	1.3% (2)
'BluE'	1.3% (2)
'Doves'	1.3% (2)
'Embrace'	1.3% (2)
'Empathy'	1.3% (2)
'Mitseezs'	1.3% (2)
'NRG Now'	1.3% (2)
5HTP	1% (1)

Table 3.5 Party pills/'liquid highs' tried by respondents* (continued)

Product/substance**	Percentage of respondents
2-PEA	0.3% (1)
'Asylum'	0.3% (1)
'Charleeze'	0.3% (1)
'Craic'	0.3% (1)
'Entrophy'	0.3% (1)
Fluorotropacocaine	0.3% (1)
'Flying Angels'	0.3% (1)
'Gold Crowns'	0.3% (1)
'Hummer'	0.3% (1)
'Ministry'	0.3% (1)
'Red Devils'	0.3% (1)
'Silver Bullets'	0.3% (1)
'Smilies'	0.3% (1)
'Super E'	0.3% (1)
'Trance'	0.3% (1)
'Trip E'	0.3% (1)
'Vegas Nights'	0.3% (1)
'XTC'	0.3% (1)
1,4 BD	0% (0)
6-APB	0% (0)
Glaucine	0% (0)
Hordenine	0% (0)
Methylhexanamine	0% (0)
n	**159**

* Multiple choice answer options were available to respondents.

** See Section 1 of this report for information regarding the psychoactive content of the party pills listed.

3.4.6 Route of administration of party pills and 'liquid highs'

The most common route of administration of party pills was 'swallowing whole' (74.2% [118]). Other popular routes included snorting (15.1% [24]) and 'bombing' (13.2% [21]), both of which involve grinding the pills into powder form before consuming them. Six respondents (3.8%) also identified the anus as a popular route of administration for party pills. This practice, known as 'bum-dropping', was mentioned by two other respondents, who claimed that while they do not personally engage in this method of administration, they are aware of others who do. 'liquid highs' are typically consumed straight, or mixed into another beverage. No respondents reported injecting party pills or liquid highs. Routes of administration are summarised in Table 3.6.

Table 3.6 Route of administration of party pills*

Route	Party pills	'Liquid highs'
Snort	15.1% (24)	0% (0)
Bomb (swallow wrapped in a cigarette paper)	13.2% (21)	1.9% (3)
Rub on gums or on inside of mouth	6.3% (10)	1.9% (3)
Swallowing whole	74.2% (118)	5% (8)
Drink mixed into beverage	6.3% (10)	9.4% (15)
Drink straight	1.3% (2)	10.7% (17)
Inject	0% (0)	0% (0)
Smoke in a joint/cigarette	2.5% (4)	1.3% (2)
Anally ('bum dropping')	3.8% (6)	0% (0)
n	**159**	

* Multiple choice answer options were available to respondents.

3.4.7 Quantity consumed

Respondents reported taking up to 12 party pills in a typical session, with most people taking two pills in a typical session. Table 3.7 summarises the range and mode of party pills and 'liquid highs' consumed by respondents in a typical session.

Table 3.7 Quantities of party pills and 'liquid highs' consumed in a typical session

	Party pills		'Liquid highs' (in shots)	
	Typical session	Largest number in one session	Typical session	Largest number in one session
Mode	2	2	0	1
Range	1-12	1-30	0-5	1-10
n	**131**	**119**	**20**	**17**

As can be seen, the use of 'liquid highs' appears to be minimal.

3.4.8 Subjective accounts of effects during use of powders, pills and 'liquid highs'

Respondents were asked to indicate whether or not they had experienced a number of effects associated with stimulant, amphetamine, hallucinogenic and dissociative substances. They were also asked to indicate if they had expected these effects, if they had experienced them. Table 3.8 presents their responses.

Table 3.8 Effects experienced while taking 'legal high' powders, pills and/or 'liquid highs'

		Experienced			If experienced, expected?	
Effect	**n**	**Yes**	**No**	**n**	**Yes**	**No**
Euphoria (intense happiness and well- being)	204	89.2% (182)	8.4% (17)	186	88.2% (164)	7% (13)
Enhanced feelings of closeness and caring for others (empathy)	197	80% (157)	16.2% (32)	169	70.4% (119)	22% (37)
Increased sexual desire	196	45% (88)	46.4% (91)	141	50% (70)	38% (53)
Heightened senses	196	68.4% (134)	25% (48)	155	70% (108)	21.3% (33)
Spiritual, supernatural, or mystical experiences	187	26% (48)	68.5% (128)	118	28% (33)	62% (73)
Hallucinations	195	40.5% (79)	56% (109)	135	35.6% (48)	54.1% (73)

Many users reported experiencing euphoria and enhanced feelings of closeness and caring for others. Increased sexual desire, which has been associated with mephedrone use (e.g. Mixmag, 2010) was reported by 45% of respondents. Four out of ten respondents reported hallucinations. Spiritual, supernatural, or mystical experiences, which can be associated with dissociative substances, were reported by a quarter of respondents.

3.4.9 Effects associated with powders

Respondents were asked to indicate if they had experienced various physiological and psychological effects as a result of using new psychoactive substances in powder form. Responses are summarised in Table 3.9.

Table 3.9 Undesirable effects experienced during use of new psychoactive substances in powder form

		Experienced			If experienced, expected?	
Effect	**n**	**Yes**	**No**	**n**	**Yes**	**No**
Palpitations	167	67.7% (113)	29% (54)	106	50.4% (57)	35.8% (38)
Chest pain	155	16.8% (28)	83.2% (129)	22	9.1% (2)	90.9% (20)
Breathing difficulties	154	19.5% (30)	80.5% (124)	27	7.4% (2)	88.9% (24)
Fear, anxiety, distress, panic	161	40.4% (65)	59.6% (96)	54	31.5% (17)	64.8% (35)
Paranoia/delusions	158	38% (60)	62% (98)	52	40.4% (21)	51.9% (27)
Aggression	158	19% (30)	81% (128)	24	25% (6)	70.8% (17)
Memory loss/blackouts	160	42.5% (68)	57.5% (92)	57	38.6% (22)	54.4% (31)
Fainting/collapse	152	4.6% (7)	95.4% (145)	7	0% (0)	100% (7)

As can be seen, palpitations were the most common of the specified effects reported by respondents. They were reported as experienced by more than two-thirds of powder users. Palpitations were also the only one of the various effects experienced by more respondents than not. Although commonly experienced, palpitations were expected by about half of individuals experiencing them. It appears that people often do not expect the effects they experience. It is possible that this lack of expectation may lead to distress for some.

Mental health effects (fear, anxiety, distress, panic) were commonly reported (40.4% [65]) and, where experienced, were expected by less than half of those experiencing them. Similarly 'paranoia/delusions' was reported by almost four out of ten 'legal high' powder users; this effect was not expected by approximately half of those users. Aggression was less commonly reported among 'legal high' powder users (19% [30]) and, where experienced, was unexpected by the majority of individuals.

'Memory loss/blackouts' during use was reported by approximately one in four 'legal high' powder users and was unexpected by just over half of these. Further exploration of this issue is required in order to identify factors which may be implicated, such as polydrug use.

3.4.10 Effects associated with party pills/'liquid highs'

Respondents were asked to indicate if they had experienced various physiological and psychological effects during use of party pills and 'liquid highs'. Table 3.10 summarises their responses.

Table 3.10 Undesirable effects experienced during the use of party pills/'liquid highs'

		Experienced			If experienced, expected?	
Effect	**n**	**Yes**	**No**	**n**	**Yes**	**No**
Palpitations	111	61.3% (68)	38.7% (43)	62	56.5% (35)	30.6% (19)
Chest pain	101	15.8% (16)	84.2% (85)	15	26.7% (4)	73.3% (11)
Breathing difficulties	98	11.2% (11)	88.8% (87)	9	33.3% (3)	66.7% (6)
Fear, anxiety, distress, panic	104	39.4% (41)	60.6% (63)	40	37.5% (15)	55% (22)
Paranoia/delusions	104	35.6% (37)	64.4% (67)	35	45.7% (16)	51.4% (18)
Aggression	97	13.4% (13)	86.6% (84)	12	25% (3)	75% (9)
Memory loss/blackouts	102	27.5% (28)	72.5% (74)	27	40.7% (11)	48.1% (13)
Fainting/collapse	96	6.3% (6)	93.8% (90)	6	16.7% (1)	83.3% (5)

Overall, the proportions of respondents experiencing the specified physiological and psychological effects were lower for party pills/'liquid highs' than for powders. This was notably the case with memory loss/blackouts. In the case of more than 60% of individuals, the use of party pills/'liquid highs' was associated with palpitations, an effect which was similar to that experienced with use of powders. Reports of fear, anxiety, distress and panic were very similar to those associated with use of powders, whereas fainting/collapse was more commonly reported in relation to party pill/'liquid highs' use. The overall expectation of effects was similar to expectations related to use of powders. The exception was chest pain and breathing difficulties, which were proportionally higher for party pills/'liquid highs'. As observed for powders, there is a discrepancy between the experienced effects and the expected effects arising from use of party pills/'liquid highs'.

3.4.11 Other reported effects experienced while taking 'legal high' powders, party pills and 'liquid highs'

Respondents were asked to indicate any other effects they had experienced while taking 'legal high' powders, pills or 'liquid highs'. In total, 77 comments were submitted by respondents who described experiencing a range of effects associated with the use of 'legal high' powders, party pills and 'liquid highs'. Comments linked to specific products and substances follow in Table 3.11. These comments must be considered in light of the challenges that exist in terms of linking products and substances with effects based on user accounts, as outlined in section 3.1. Comments are unedited.

Table 3.11 Subjective effects linked to named substances and products – respondents' comments (unedited)

Substance/product	Comment
BZP	BZP caused me stomach pain, however I have chronic gastritis anyway so it aggravated this. BZP is the only one that made me feel a bit scared later on.
	BZP pills often make my stomach feel sick, and after an initial high I feel irritable and sort of like I don't want to be anywhere or talk to anyone. This is before the come-down.
	BZP which is contained in the exotic pills was a pointless experience. Again, I felt more energetic and confident but it caused me stomach problems such as heartburn and pain – most likely due to gastritis. I also found my jaw clenching and teeth grinding. Unpleasant experience.
	With BZP a almost constant desire to go to urinate whilst not actually being able to.
'Charge'	Twitchy and feeling of lots of energy.
'Cherry Pop'	Strange high, similar to ecstasy, but less euphoria. The bad side effects were amplified however with an increase of heart rate I'd never experienced before, nausea and insomnia. From a coming down/side effects point of view, much more potent then any illegal stimulant I've taken
'Doves'	'Doves', pills which contain ketones. Great experience, have used on two occasions but would find pointless to use it more often, for example on a regular night out, more so for festival use or exciting occasion. Had no problems with this drug, it did not cause insomnia in my case. The only noticeable change was a feeling a happiness with a sense of confidence. I remember almost everything that happened while I was high and personally would prefer it to the effects of alcohol which feel much more negative.
'Exotic'	Everyone else in the group was having fun, talking and drinking however I just want to sit at home in front of the TV and relax.
'Giggle' and 'Diablo'	Energy fluctuations – feeling really energetic one minute and exhausted the next.
MDPV	severe blurred vision after mdpv
Mephedrone	Mephedrone makes me shiver.
	They have a laxative effect, cause dry mouth and alter taste sensations. Mephedrone reduces appetite.

Table 3.11 Subjective effects linked to named substances and products – respondents' comments (unedited) (continued)

Substance/product	Comment
	Talking ALOT of shit. – methphedrone. >Emotional Dr. Phil-tpye conversations about feelings, friendships and conflicts. > increased Energy –ability to stay up all night dancing to crap music – never wanting to sit still until crashing.
	Lower arms and legs went numb for about 20 mins. Then got a major buzz.
	Pins and needles in my arms.
	Alertness. Heightened awareness of my body.
	A feeling of openness, ie. talking a lot lot more than usual,however this was an enjoyable experience. Once a user knows what the effects are, they have a far more enjoyable time. New users not familiar with the effects start to panic as the effects begin to take place, LEGAL HIGHS SHOULD STAY LEGAL! regulation and proper advertising of effects are needed however.
	Total loss of appetite
'NRG'	Cant piss..Extreme paranoia espically on nrg.
'Silver Bullets'	Never taking them agin lol, silver bullets is all ive taken, 2 years ago.
	I tried Silver bullets, they were made by funk pills, they also made flying angels etc, I dont no what the active ingredient of them was, Id love to find out, i think funk pills were a new zealand based company,, Id never agin take anything after, i dint sleep or eat for like 2 days and my heart was racing.
	magic,little devils(came with a vitC tab that was serious wen coming down,charlies,silver bullets (best by far cant overdose if your not trying the more you take the more the effects are heightened better with drink lik all above things but wen you take 5 in 3
'Snow Blow'	wildcat but dere all shite, i dont understand how any1 could become addicted to em. drink and powder is unreal tho snowblow was the closest to speed.
	Vomiting.
	This stuff was horrible, had me out of control all night, I couldnt sleep for almost 48 hours,I will never touch this filth again.
	Talking bullshit all night long
	Jaw grinding
'The Business'	The Business – similar to "Magic" but not as potent or immediate an effect.

General comments in relation to effects from 'legal high' powders, pills and 'liquid highs' are presented in Table 3.12 (unedited).

Table 3.12 Subjective effects experienced by users while taking powders, pills and 'liquid highs' - respondents' comments (unedited)

Effects	Comments
Psychological/ Cognitive/Behavioural	anxiety attack and paranoia leading me to be taken to loughlinstown hospital and stayed for 2 days, paranoia over my contacts being broken in my eyes leading me to gauge at them and having to go to eyeneir hospital, black out and my tooth going through my lip
	ability to stay awake for long periods, more chatty.
	calm and confidence, good feelings
	Completely paranoid. Felt as though I was going to die and it was my last few moments to live. Very scary. INCREDIBLY GLAD ITS GONE, As as much as I hated it.. couldnt say no to it being offered and because it was so accessible we would buy it
	excitment..complete unconditional happiness.not caring about anything. every1s a friend.etc
	Feeling disconnected with surrounding. Clear headed, but not pleasant.
	hysteria
	just complete calmness and other times just mad to dance etc
	Most common is people's hair appearing to turn purple
	suicidal and wanting to harm my parents it was a really frightening experience
	Talkative
	talking a lot
	Talking bullshit all night long
	Talking non-stop about crap
	Talking too much, over-honesty, telling private matters to strangers
	Talking very fast – speed effect
	the feeling of being really out of it not in control but not high at all
	lack of deciseveness
	extremely clear thinking, inability to roll cigarettes
	frustration and the need to do something to keep busy not able to sleep, and being ableto consume larger amounts of alcohol than otherwise and staying sober
	The times I have taken these kind of legal highs, there has also been illegal highs involved

Table 3.12 Subjective effects experienced by users while taking powders, pills and 'liquid highs' - respondents' comments (unedited) (continued)

Effects	Comments
Physiological	An increased heart rate was experienced, it was not an abnormal rhythm, just fast.
	Amazing Orgasms!
	Blanked out and started to vomit blood, turned out all in red blotches and then turned grey, thought i was going to die, wanted to fone an ambulance but i couldnt get to my phone.
	Breathing difficulties-due to asthma. Fear, anxiety, distress or panic-due to events that would came this even if sober but enhanced. Expected?-all depends on quantity re. must bad things, well and amazing spirtual things.
	cramp,stomach pain.
	I have seen a friend of mine go into an altered state where she started foaming at the mouth. The most extreme effects I myself experienced was tightness in my chest and palpitations which lasted 16 hours approx
	Loss of appetit. lack of sleep.
	felt like fainting, i dont think the smoke was as bad as the pills.
	I found it hard to swallow.
	had to go to hospital after 3 days of increased heart rate, chest pains and trouble passing urine
	insomnia
	Extreme Heightened Sexual desire.
	ischuria
	Lost interest in sex. Dehydration. Thirst for water. Urinated alot. Had cravings for the lines. Gained an OCD about making the lines perfect.
	Nausea
	need for constant movement,need for trance massive urge to dance
	Nervousness, the desire to clench my fists in anxiety or shake vigorously.
	nosebleeds
	not being able to sleep. nightmares
	Pains in my hands and feet
	physical tics or repeated comforting motions w/hands, grinding teeth, excessive sniffing and swallowing, rapid speech, widened eyes. ll of the above effects were easily controllable, at moderate to low doses.
	plentiful energy talkative
	puking
	Staying awake
	very fast heartbeat. nosebleeds, extremely cross-eyed
	Vomiting, the sweats, super heat/super cold(alternating)

3.4.12 Come-down effects of 'legal high' powders, party pills and 'liquid highs'

Respondents reported experiencing come-down effects from powders, pills and 'liquid highs' for between 0 and 28 days, with the average number of days being 2.01 (sd = 2.476) [n = 147]. Table 3.13 summarises come-down effects and users' subjective intensity ratings for powders, and Table 3.14 for party pills/'liquid highs'. The most commonly reported come-down effects from both powders and party pills/'liquid highs' were insomnia and low mood, sadness and depression. Insomnia and 'fear, anxiety, distress or panic' were experienced in larger proportions of party pill/'legal high' users than among those who used powders. Palpitations were more commonly associated with powders, although reported for both powders and party pills/'liquid highs'.

Table 3.13 Come-down effects and their rated intensity – powders

	Experienced			Intensity
	n	Yes	No	n	(1 least -10 most)
Insomnia	170	73.5% (125)	24.7% (42)	119	6.72 (mean), 2.636 (sd)
Low mood, sadness, depression	170	71.8% (122)	27.6% (47)	115	5.89 (mean), 2.681 (sd)
Fear, anxiety, distress or panic	163	44.2% (72)	54.6% (89)	66	5.76 (mean), 2.967 (sd)
Paranoia/delusions/ hallucinations	157	33.1% (52)	66.2% (104)	49	5.37 (mean), 2.352 (sd)
Palpitations	159	47.2% (75)	52.2% (83)	73	5.64 (mean), 2.502 (sd)
Chest pain	153	20.9% (32)	76.5% (117)	31	5.00 (mean), 2.338 (sd)
Breathing difficulties	155	18.7% (29)	77.4% (120)	28	4.50 (mean), 2.472 (sd)

Mean intensity ratings for effects were similar across powders and party pills/'liquid highs'. Palpitations were rated as most intense among both powder come-down effects and party pills/'liquid highs' come-down effects.

Table 3.14 Come-down effects and their rated intensity – party pills/'liquid highs'

	Experienced			Intensity
	n	Yes	No	n	(1 least -10 most)
Insomnia	120	81.7% (98)	18.3% (22)	95	6.95 (mean), sd 2.822
Low mood, sadness, depression	115	69.6% (80)	30.4% (35)	78	5.49 (mean), sd 2.480
Fear, anxiety, distress or panic	110	47.3% (52)	52.7% (58)	50	5.23 (mean), sd (2.575)
Paranoia/delusions/ hallucinations	104	30.8% (32)	69.2% (72)	30	5.03 (mean), sd (2.859)
Palpitations	110	42.7% (47)	57.3% (63)	46	5.07 (mean), sd (2.175)
Chest pain	106	17.9% (19)	82.1% (87)	17	3.94 (mean), sd (1.749)
Breathing difficulties	105	13.3% (14)	86.7% (91)	14	3.57 (mean), sd (2.821)

3.4.13 Other effects experienced during the come-down from 'legal high' powders, pills and 'liquid highs'

Respondents were asked to give a brief description of other effects they have experienced during the come-down from powders, pills and 'liquid highs'. Their responses are presented below (Table 3.15) and are unedited. Mental health-related issues appear to predominate. Subjective effects linked to named substances and products are reported in Table 3.16, which follows. As mentioned previously, it is difficult to link subjective effects with specific substances.

Table 3.15 Other effects experiences during the come-down from powders, pills and 'liquid highs' – respondents' comments (unedited)

Effects	Comments
Psychological/ Cognitive/Behavioural	-In the hours after last lines were taking i suffered cravings for more -insomnia, -depending how much i had taken i could be watching the wall and in my semi sleeping state pictures would appear before my eyes then change to something else rapidly.. like id see a picture of a dog, change to a cat, change to a bird, change to a person but as it was all 2D i dont think it was an halusination -Id have no energy - if i used to much i couldent eat or drink without throwing up, id keep breaking into a cold sweat and my pupils would remain large up to 15 hours after last line
	embarrasment over what i have said while high.
	dehydration and an anxiety diss order for months followed, my pupils were huge for 2 days, and my hart was racing.
	Extremely low and edgy. Lungs felt sore with a peculiar tasting phelgm being coughed up
	Feelings of isolation and paranoia.
	Feeling of otherworldliness, not quite in this world..
	Feeling slightly fed-up 2-4 days later. Very subtle paranoia/low mood, too subtle to certainly attribute to powders (or pills).
	head racing unable to 'switch off'
	I felt devoid of energy, depressed about anything beyond the current, tired constantly and suffered from intense sharp short electric shocks in the head, for approx 2 days after
	I would refer to this as a 'scag'. In the past I have suffered this from dirty ecstasy pills (supposedly those with heroin in them). The only thing I have experienced that has a scag comparable with legal highs is sticky 'base' speed. It is the worst feeling of nausea/depression/worthlessness I have experienced.
	i got a feeling of pins and needles in the back of my head, to do with the panic attack. i only get panic attacks when i dont sleep for a couple of days and drink alot. i never get most of the above feelings from just one night of taking these drugs.
	Insomnia is the worst, it allows the others to occur, if you could sleep it off there would be no anxiety depression etc etc etc
	just feeling worn out tired etc, Notting worse than a night drinking , its much worse for me to drink on a night out,
	Just tired and couldnt sleep not very happy either but im unhappy hungover too so not a problem

Table 3.12 Subjective effects experienced by users while taking powders, pills and 'liquid highs' - respondents' comments (unedited) (continued)

Effects	Comments
	legal high powders release lots of endorphines into the body, and after prolonged use of them, it gets to the stage where one is incapable of enjoying anything without under the influence. Probably because the body has been numbed to the natural release of endorphines or possibly due to the longing or only thinking about doing one more line. Depression is a high side effect of prolonged use and it does take a while of self determination to finally be capable of enjoying daily routines or even social activities
	Made me never want to do it ever again, was awful. Was not a drug user but turned me off ever doing anything ever.
	Never felt a come down
	not bein able to sleep..stomach pains.difficulty passing urine..serious weight loss.no appetite..good moods..sudden depression..lack of concentration or care about things
	Paniced .. couldnt function properly.. emotional wreck
	pure depression anti social behaviour cant get comfortable skin feels like leather
	Scattered thoughts. Lethargic. Depression.
	sense of falling
	severe depression, agression, irratibility, slurring of speech, slow thought process, constant fatigue
	suiscidal
	the come-down from powders were ok,it was never to intense even after alot. The pills were sick. very intense. It was like having the DT's
	The times I have taken these kind of legal highs, there has also been illegal highs involved, but I generally do not get very bad come-downs
	tiredness
	Tiredness, moodiness, always a 2 day hangover
	Any of the come-down I have had from legal highs are no worse then what you would experience from a bad hangover.
	Fear, anxiety, distress or panic. Paranoia/delusions on coming down not really while high
Physiological	extreme chills, muscle mass loss,body fatloss, loss in appitite.come down was livable after day of resting but still present to a certain degree for two, no come down of most pills wen taken in stated dosage.
	bad headaches, shaking,muscle spasms, less movement in fingers and toes and badly bloodshot eyes
	being mad for more drugs, all you want is to come back up when you come down.
	blocked nose. If i tried to clear it i would get a nose bleed.
	dehydration and an anxiety diss order for months followed, my pupils were huge for 2 days, and my hart was racing.

Table 3.12 Subjective effects experienced by users while taking powders, pills and 'liquid highs' - respondents' comments (unedited) (continued)

Effects	Comments
	Did not "suffer" a come-down as bad as has been mentioned by my mates. The insomnia was hoorendous.
	extreme fatigue
	Extremely low and edgy. Lungs felt sore with a peculiar tasting phelgm being coughed up
	Fatigue.
	Good times while you're partying but when you want to stop and rest, the insomnia is awful.
	I've only ever tried legal pills once, i found the only effect was insomnia, comparative to 5 cups of coffee.
	I don't do legal highs anymore as I didn't like the feeling from them an the insomnia from them is what really put me off them when trying to sleep after a night out on them
	I've seen people have terrible come downs that last for a week. Also seen a friend hospitalised from swallowing some power and he had to have fluid drained from his neck.
	Insomnia is the worst, it allows the others to occur, if you could sleep it off there would be no anxiety depression etc etc etc
	no appetite
	not bein able to sleep..stomach pains.difficulty passing urine..serious weight loss.no appetite..good moods..sudden depression..lack of concentration or care about things
	Nothing just apart from craving more.
	loss of appetite, decreased labiedo.
	Migraine, fever, shaking
	puking again...
	really bad hang over. tierd, ill and useless
	Really bad headaches
	restless legs, twitching, fear of light and day.
	The Shits.
	very tired however the mind is restless, when I did sleep it was not a deep sleep
	Twitching. 'Electric shock' sensation
	vomating
	vomitting next day..all day
	Was almost completely sober after 15 minutes snorting even though I had drank heavily before taking the legal drug.

Table 3.16 lists come-down effects which respondents attributed to named 'legal high' powders and pills.

Table 3.16 Subjective come-down effects linked to named substances and products – respondents' comments (unedited)

Substance/product	Comments
'Blessed'	After doing blessed pills I didnt slepp for 3 days-the worst experience of my life.
'Blow'/'Wild Cat'	mini seizure after blow/wild cat mini seizure after blow/wildcat, had no control of my body just froze up and was hearing very strange/frightening noises, also alot of paranoia that night too
BZP	BZP caused headaches and extreme sensitivity to light and extreme insomnia worse than any other drug
	BZP has been the only drug that has caused these symptoms for me.
	Quite bad teeth grinding with BZP
	Feeling of otherworldliness, not quite in this world..
'Charge'	A lot of energy the next day, hyper and giddyness, followed by a hangover(possible due to alocohol being taken as well as the blow).
'Diamond Dust'	After 'Diamond Dust' the next day was a write off. I wasn't hungover, just groggy.
'Exotic'	very tired however the mind is restless, when I did sleep it was not a deep sleep
Mephedrone	Much much much worse than any illegal drug i have ever taken. The come-down from mephedrone has been so bad that i worried if my mind would ever recover. I will never take any of that shit again.
	Never felt a come down
	"Rattled"
'NRG-1'	paranoia, now experience it regularly..dont take drugs anymore..nrg-1 is very bad for this. only had it once but i think it is quite dangerous..
'Silver Bullets'	dehydration and an anxiety diss order for months followed, my pupils were huge for 2 days, and my hart was racing.
'Whack'	whack put 3 of my friends in hopital thinking they were going to die their heart and head were in a state

3.4.14 Health concerns associated with 'legal high' powders, party pills and 'liquid highs'

When asked about health concerns associated with the use of powders, party pills and 'liquid highs', 46% (91) of respondents reported having had concerns for their physical health and 41.2% (80) reported having had concerns for their mental health. Despite this, over half of those using powders and/or pills/'liquid highs' reported not having had concerns for their physical or their mental health. As can be seen in Table 3.17, few respondents had ever consulted a GP or a mental health professional as a result of their use of 'legal high' powders, party pills and/or 'liquid highs'. Three respondents (1.6%) had received emergency medical attention as a result of their use of these substances.

Table 3.17 Health concerns and assistance sought by users of powders, party pills and 'liquid highs'

Health concern/behaviour	n	Yes	No	I'm unsure
Concerns for physical health	198	46% (91)	52% (103)	2% (4)
Concerns for mental health	194	41.2% (80)	56.2% (109)	2.6% (5)
Received emergency medical assistance	191	1.6% (3)	98.4% (188)	0% (0)
Consulted a GP	193	2.1% (4)	97.4% (188)	0.5% (1)
Consulted a mental health professional	190	3.7%(7)	95.8% (182)	0.5% (1)

Despite many respondents reporting concerns for both their physical and mental health, it appears very few are seeking help from health professionals. Respondents were asked to give brief details if they had answered 'yes' to having health concerns or having consulted a healthcare professional. The comments below illustrate some of the specific health concerns reported by users of powder, party pills and 'liquid highs'. The comments are unedited.

Table 3.18 Respondents' comments regarding health concerns as a result of using 'legal high' powders, party pills and/or 'liquid highs' (unedited)

Effects	Comments
Psychological/ Cognitive/Behavioural	Addiction
	bad come downs are hard to deal with
	Anxiety and paranoia toughts took over coudlnt face outside world
	because i was unsure of what was in them, i was unsure what effects they could have on my mental health.
	Come down is exceptionally rough, significantly moreso than street alternatives.
	Drugs can obviously damage your brain. I have had concerns that what I am doing is absolutely idiotic - I have grown up and dont do it anymore.
	concerns for physical and mental health as in the knowledge I shouldn't be doing this and what effects it may have on me at a later stage.
	Continuing treatment/counselling from a mental health professional, as a result of physical assault 18months ago.

Table 3.18 Respondents' comments regarding health concerns as a result of using 'legal high' powders, party pills and/or 'liquid highs' (unedited) (continued)

Effects	Comments
	feeling strange not yourself
	Had concerns re nose bleeds and heart racing. Also during the comedown had mental health concerns, was ery depressed for a week after prolonged use of powders.
	I am still worried about my mental and physical use because of the times I tried these drugs.
	I do wonder what damage mephedrone does to the brain.
	i felt moody the next day
	I felt very depressed after a session of legal highs. I dont think the up balances out with the downward effects so I stopped taking it
	I found the heart palpitations and slightly addictive nature of the powders to be distressing
	I googled the internet alot from stimulant drug brain damage, and i have come to the conclusion that ill be alright
	I have been aware of the potential risks posed by the stimulant effect of Meph and also of the lowered mood, as such I make sure use is very occasional.
	I have occasionaly become slightly paranoid that i have taken too much and as a result may become seriously ill or even die
	I have some knoladge about side affects while using a drugs, no exeption for legal hights, but i find it extremely intresting..
	I thought I might stay in a state of panic and anxiety for life and start to lose my mind
	I tried bzp once. Not much attention had been brought to the fact that it's an untested chemical and before taking it i hadn't really thought of this aspect of it.
	I was very worried after the last time I took legal highs that I may have caused myself permanent damage due to the lasting side effects which affected me for approx 5-6 days after I had stopped taking the substances
	I was worried after using party pills because they made me paranoid and i experienced hallucinations.
	I went to see a doctor because my depression got so bad, then I ended up on a phyciatric ward in a mental hospital for 4 months..
	its in a way addictive, very parinoid and aggresive next day
	know that it isnt good for the body but it feels good at the time.
	My brain is fragile after an accident years ago so my mental health is always a thought in the back of my mind to be honest
	Palpitations have freaked me out at times. I konw of experienced users of class A substances who have lost the plot (anxiety, freaking out)on party pills. Personally they have caused me depression lasting up to 5 days depending on the amount consumed.

Table 3.18 Respondents' comments regarding health concerns as a result of using 'legal high' powders, party pills and/or 'liquid highs' (unedited) (continued)

Effects	Comments
	only because of what id read in the papers and the fact that technically we are the test dummies for these as there seems to be little research/testing done on them
	Palpitations are scary
	Palpitations scare the shit out of me, have been taking drugs for years and never felt anything like the comedown from legal highs. Much worse than most illegal drugs such as mdma, speed, coke etc. Anxiety attacks are much worse as well.
	paranoia, heart palpitations and panic attacks when comin down after a combination of booze powder/pills and not sleepping
	Paranoia.
	psychiatrist tawt people were planting tawts in my head
	Really increased my drug intake (meph, etc.) in 2nd semester. Turned out my exam results improved. Go figure!
	Sickness for about 2 days as well as bad paranoia, insomnia, and depression
	Sleep deprivation causing doubts in mental well being.
	Taking drugs of any description for days on end is never good for your health.
	There is only so much the mind can take for a duration of madness
	thought my heart would blow out of my chest, my head went crazy manic depression, aggression "when will this end"
	tried to read as much as possible on internet before use. obviously some times on the comedown you never think you'll be right again. but then you sleep and wake up fine.
	unable to concentrate for weeks
	Was unsure of long term effects.
	Was worried if there were long term side-affects for my mental or physical health.
	worry about future effects
	Worry sometimes about long-term effects.
	would be worried about heart palpatations and not being able to sleep during use and for a day or two after experienced alot of anxiety and sometimes nearly depressed
	You can't help but worry about the effects of drugs.legal or not

Table 3.18 Respondents' comments regarding health concerns as a result of using 'legal high' powders, party pills and/or 'liquid highs' (unedited) (continued)

Effects	Comments
Physiological	
	after taking 'liquid highs' i noticed a break out in pimples and i developed a rash around my mouth after taking party pills
	As previously mentioned, gastritis was aggravated by bzp
	Could sleep for 3 days after blessed pills. was very concerned
	chest pains not able to sleep for long periods severe depression
	felt extremely unwell after the pill i took
	Come downs resulted in physical pain (ie. chest pain, insomnia and palpitations) and mental pain (anguish and guilt)
	Had concerns re nose bleeds and heart racing. Also during the comedown had mental health concerns, was ery depressed for a week after prolonged use of powders.
	had to go to hospital as a result of lack of sleep exaustion, weight loss and palpitations
	Heart palpitation leads to concern but the expected high and come down prepares you for concern of personal mental health
	I always have niggling concerns for my mental health but after a period of excess I get jumpy and have bouts of depression and can become very introverted.
	heart papiltations, genuinely thought i was going to have a heart attack, scared the life outta me
	I had a vomitting fit which led to me not being able to catch my breath.
	i was just slightly worried about the heart palpatations links bzp has to physhtzofrinia
	makes your body feel strange heart beats to fast and i see my male friends sweating alot
	Increased heartbeat, no more so than if using illegal highs
	Mephedrone is the devil
	I was pretty worried about my experience from doing mephadrone.It gave me an unnatural feeling in my body,unlike any feeling you would get from taking ecstasy.I had severe tightness in my chest and irregular breathing which lasted a long time and in turn made my panic.I thought I might have to call an ambulence,luckily I didnt have to and I slept it off.
	Seemed so moreish (mephedrone products) had to get out of the scene of the people who were regularly taking it to return to normal health. Found myself taking it alone for about one month. Quit all use of it 7 months ago. Mental and physical health feel back to normal now.

3.4.15 Risk minimisation behaviours of users of 'legal high' powders, pills and/or 'liquid highs'

Respondents were asked to indicate the frequency with which they engage in a number of behaviours intended to minimise the risk associated with taking new psychoactive substances such as powders, party pills and/or liquid highs. Table 3.19 presents the responses.

Table 3.19 Risk minimisation behaviours of users of powders, party pills and 'liquid highs'

Behaviour	n	Always	Very often	Some-times	Rarely	Never	Not applicable
Reading instructions (where given)	201	31.3% (63)	12.4% (25)	13.4% (27)	12.4% (25)	23.9% (48)	6.5% (13)
Following dosage on package (where given)	200	12.5% (25)	13% (26)	13.5% (27)	15% (30)	34.5% (69)	11.5% (23)
Research online to find out ingredients	199	19.6% (39)	18.1% (36)	18.1% (36)	7.5% (15)	34.4% (69)	2% (4)
Research online to find out dosage	200	17% (34)	12% (24)	14% (28)	10.5% (21)	44.5% (89)	2% (4)
Taking small amounts to test strengths and effects	200	34.5% (69)	15% (30)	20.5% (41)	9% (18)	19.5% (39)	1.5% (3)

As can be seen, just over one-third of users of powders, party pills and 'liquid highs' reported always engaging in staged dosing, whereby small amounts of the substance are taken in order to gauge its strengths and effects. Despite this, nearly 20% reported 'never engaging in staged dosing' and 9% (18) 'rarely'. A minority of individuals reported 'always' or 'very often' following dosage instructions on packages, despite the fact that almost a third of respondents reported that they did read them. It also appears that many respondents do not use the Internet to research the product ingredients or dosage.

3.4.16 Smoking blends and ethnobotanicals

In total, 197 (60%) out of 329 respondents reported having used between one and 16 smoking blends, with most having tried just one (28.9% [57]). The list of 41 smoking blends reported by respondents, and their rate of reporting is presented in Table 3.20.

Table 3.20 Smoking blends tried by respondents*

Product**	Percentage of respondents
'Smoke XXX'	74% (145)
'Spice'	66% (130)
'King B'	35% (69)
'Smoke 2'	30% (59)
'Suma Gold'	13% (25)
'Mayan Shine'	3.6% (7)
'Smoke'	3.6% (7)
'Ignite'	3.1% (6)
'Magic'	2.5 % (5)
'Pulse'	2% (4)
'Bonzai'	1.5% (3)
'Bonzai Citrus'	1.5% (3)
'Smoke Plus'	1.5% (3)
'Yucatan Fire'	1.5% (3)
'Zohai sx'	1.5% (3)
'Genie'	1% (2)
'King BBB'	1% (2)
'Red Eye'	1% (2)
'Smoke XXXX'	1% (2)
'Space'	1% (2)
'Spice Diamond'	1% (2)
'Black Amsterdam Gold'	0.5% (1)
'Cahoots'	0.5% (1)
'Firefly'	0.5% (1)
'Firefly Plus'	0.5% (1)
'Firefly Resin'	0.5% (1)
'Galaxy'	0.5% (1)
'Ice Bud'	0.5% (1)
'Juicy'	0.5% (1)
'JWH-018'	0.5% (1)
'Magic Gold'	0.5% (1)
'Mayan Bliss'	0.5% (1)
'Mayan Journey'	0.5% (1)
'Mellow Yellow'	0.5% (1)

Table 3.20 Smoking blends tried by respondents* (continued)

Product**	Percentage of respondents
'Neder Gold'	0.5% (1)
'Pure Gold'	0.5% (1)
'Skull Cap'	0.5% (1)
'Sky High'	0.5% (1)
'Smoke 1'	0.5% (1)
'Snicuichi'	0.5% (1)
'Tribe'	0.5% (1)
n	**197**

* Multiple choice answer options were available to respondents.

** See Part 1 of this report for information regarding the psychoactive content of products.

'Smoke XXX' and 'Spice' were the most frequently reported types of smoking blend, being tried by 74% (145) and 66% (130) respectively of those who have used smoking blends. 46 (14%) respondents reported having used an unknown smoking blend.

Those who used smoking blends did so on between zero and 31 days in the previous month, with 73.8% (138) not having used them on any day in the previous month [n = 187]. The highest number of consecutive days on which respondents used smoking blends was 100 days (0.6% [1]) [[n = 177].

The use of ethnobotanicals was reported by 38.3% (126) of survey respondents [n= 329]. Respondents reported trying between one and 11 types of ethnobotanical. Table 3.21 presents the list of different ethnobotanicals tried, as well as the rate of reporting by respondents of each type of ethnobotanical tried.

Table 3.21 Ethnobotanicals tried by respondents

Product/substance**	Percentage of respondents
Salvia divinorum	61.1% (77)
Hawaiian Baby Woodrose	16.7% (21)
'Fly Agaric' (Amantia Muscaria)	13.5% (17)
Morning Glory (Convolvulvus)	13.5% (17)
Peyote	8.7% (11)
San Pedro	7.9% (10)
Psilocybin mushrooms	7.1% (9)
Kratom	10.3% (13)
Ayahuasca	2.4% (3)
Datura stramonium	1.6% (2)
Acorus calamus	0.7% (1)
Unknown variety of truffles	0.7% (1)

* Multiple choice answer options were available to respondents. n = 126.

** See Part 1 of this report for information regarding the psychoactive content of products/substances.

Salvia divinorum was by far the most frequently reported enthnobotanical tried, with 23.4% (77) of all survey respondents reporting its use [n = 329], and 61.1% (77) of those who have tried any ethnobotanicals reporting its use [n = 126]. Reports of using an unknown ethnobotanical substance were made by 34.9% (44) of survey respondents [n = 329].

Those who used ethnobotanicals did so on between zero and 25 days in the previous month, with 75.2% (82) not having used ethnobotanicals in the last month [n = 109]. The highest number of consecutive days on which respondents used ethnobotanicals was 14 days, the mode being one day [n = 102].

3.4.17 Health concerns associated with smoking blends and ethnobotanicals

As can be seen in Table 3.22, almost a third of respondents reported concerns for their physical health, and just over a quarter reported concerns for their mental health as a result of the use of smoking blends and/or ethnobotanicals. Despite this, few individuals have accessed healthcare professionals in relation to their concerns. It can also be seen that approximately two-thirds of those who have used smoking blends and/or ethnobotanicals did not report concerns for their physical health. Similarly, approximately two-thirds did not report concerns for their mental health as a result of using these substances. As with those using powders, pills and 'liquid highs', a small proportion (1.5% [3]) reported receiving emergency medical attention as a result of their use of these substances.

Table 3.22 Health concerns and assistance sought by users of smoking blends and ethnobotanicals

Health concern/behaviour	n	Yes	No	I'm unsure
Concerns for physical health	202	33.2% (67)	64.4% (130)	2.5% (5)
Concerns for mental health	202	27.7% (56)	67.8% (137)	4.5% (9)
Received emergency medical assistance	200	1.5% (3)	98% (196)	0.5% (1)
Consulted a GP	201	2% (4)	97.5 % (196)	0.5% (1)
Consulted a mental health professional	200	1.5% (3)	97.5% (195)	1% (2)

The comments presented in Table 3.23 illustrate some of the health concerns cited by respondents in relation to smoking blends and ethnobotanicals. The comments have not been edited. Comments linked to specific named substances and chemicals are presented in Table 3.24.

Table 3.23 Respondents' comments regarding health concerns associated with their use of smoking blends and ethnobotanicals (unedited)

Substance/product	Comments
Smoking blends	Bad chest and muscular distrophy from lack of doing stuff
	difficulty in breathing
	feeling low and lethargic. unmotivated.
	Gain in weight. (Munchies)
	worried I was getting lazy, not getting enough exercise and eating too much.
	I was worried it was frying my brain. I've cut back on smoking in a big way in the last 6 months
	I had concerns over my lungs, as I would be coughing the morning after smoking but this would go away after about 10 mins.
	i was concerned about the effects on the throat/lungs, also had some headaches as a result of smoking some blends
	I enjoyed mixing a little of the smoking high with tabacco and having a smoke in the evening after work in my home
	Many of the old smoking blends (ie.Yucatan fire) as they give a much more enjoyable 'high' than illegal alternatives. Also, I liked the fact thet my money wasnt going into the hands of a scumbag drug dealer.
	got chest pains and irrigular heart beat. Started to get dependant on it
	hallucinations, heart palpitations, panic attack
	heart papiltations, genuinely thought i was going to have a heart attack, scared the life outta me
	heart pelpertations, head spinning, lossof motor functions.
	heart racing, felt cold, shivered alot. thought i was going to have a heart attack.
	heart rate increase, heavy breathing
	collapsed
	Concerned after not been able to sleep well for weeks after!
	Consulted a GP/Consulted a mental health professional-internet,book research
	Just Didnt know what was in it, make you tired the day after.
	Lots of stories about passing out due to smoking blends
	during use experienced slight paranoia about mental and physical health
	ive had concerns, but never went any furhter than that. you cant tell if there are any long term effects so you kind of just think that it is harmless.im not too worried though
	I felt quite sick
	i`m just afraid of cancer (as well as with smoking tabaco)

Table 3.23 Respondents' comments regarding health concerns associated with their use of smoking blends and ethnobotanicals (unedited) (continued)

Substance/product	Comments
	Many of the smoking blends on the market have a slightly different effect to cannabis. Many of them tend to cause paranoia and can be much more habit forming than cannabis herb. Call me a traditionalist but I will be sticking with the natural stuff.
	menatl health concerns, regarding smoke, paranoia (mild) maic eppisodes, altered mood and perception
	My uncle is a psychiatrist specialising in drug users so I asked him about any effects it might have any me.
	Not a fan of smoking, although I realise I may have been doing so for the last 5 years when drinking/smoking herbs.My asthma seems to hae returned.
	paro thought i would never loose this state of mind
	Smoking is bad for the lungs and other organs doesn't matter if it's pot, tabacco or blends. I sometimes get a little worried about the silly things I have done during the day say at work and when I smoke I dwell on it more. Although in saying that smoking does relieve my stress after a hard day and helps me to relax
	smoking to much can lead to a lazy frame of mind. can lead to lack of exercise and boredom which has a knock on effect on mental and physical health
	some mild paranoia, worry about future effects
	the initial experience was magnificent it seemed as though I was in another world and I could do anything while sitting in the safety of my kitchen unfortunately I began missing the normal world and became paranoid I would never get home obviously I did
	The smoking blends don't feel natural, like weed, or natural hallucinagenics
	Thought was going to die.
	Unpredictable effects, resulted in what could be described as panic attacks.
	very anxious after
	very poor breathing sometimes, very raw
	Was worried if there were long term side-affects for my mental or physical health.
	you start to act parinoid, and grouchy,startin arguments, i stoped wen noticed
	serious hallucinations paranoia and panic attacks
	uncertainty regarding the ingredients and their effects on physical and mental health
	Scared of the effects on my brain Scared of the effects on my heart
	Smoking bad for lungs.
	smoking blend smells like burning plastic and stained my friends fingers for days

Table 3.23 Respondents' comments regarding health concerns associated with their use of smoking blends and ethnobotanicals (unedited) (continued)

Substance/product	Comments
Ethnobotanicals	Bad trip = Temporary Insanity
	Hypnopompic/hypnocognic hallucinations due to continued Salvia, weed and other hallucinogen use over a period of five/six years. Treatment; stop taking drugs, get more sleep. Full recovery, occasional relapse when any of above substances are consumed. Generally, decision considered to be worth it ;)
General	I am still worried about my mental and physical use because of the times I tried these drugs.

As can be seen, more comments were made overall in relation to smoking blends than in relation to ethnobotanicals. The following comments (Table 3.24) were made in relation to specific smoking blends and/or ethnobotanicals.

Table 3.24 Respondents' comments in relation to named smoking blends and ethnobotanicals (unedited)

Substance/product	Comments
'King B'	After being smoking what was 'King B' I found myself gaining a mental addiction which although I didn't want and could easily have fought, I never said no when it was put in front of me and this continued for months.
	smoked king b for about six months solid and was getting very forgetfull
'Smoke 2'	depression anxiety, may not necessarily have been brought on by smoking though
'Smoke Plus'	smokeplus is addictive not mentally lik all the rest but phisically(giving up spelling that, i forget how to spell words from time to time)you get chills lack of appitite,moodswings,shakes,cant sleep but all the otherones had no addictive qualities.
	i smoked smoke xxx without knowing the strong effects it would have. i started blacking out, panicing, had troubles breathing and my whole body turned red and i started shaking. an abulance had to be called and i spend 5 hours in hospital on an oxegen mask and the drop coming down of the drug. it was the most horrible and terrifying experience of my life.
	knew I was smoking a man made chemical. Untested, felt like a human guinea pig. Considered myself addicted at the time. Smoked xxx for about 6 months till I quit about 7 months ago
	When i tried one of the blends, Smoke XXXX i felt very ill, couldent move, all my muscles relaxed to the point that i excreted and couldent talk for 30minutes
	After smoking Smoke on an occasion the following day I felt extermely lethargic and depressed. I never smoked it again after that. It was one of the worst feelings I've ever felt.
	i experienced a red face and baggyness and bloodshot eyes and felt very paranoid .

Table 3.24 Respondents' comments in relation to named smoking blends and ethnobotanicals (unedited) (continued)

Substance/product	Comments
'Spice'	headaches is all
	my mental health has always been shot:)
	bouts of severe depression and anti social behaviour which was totally out of character
	When i tried smoking blends i did not know they contained untested research chemicals (this was in their early days). The product packaging and websites had lead me to believe they were completely herbal blends (the website of one product contained the false assetion that it contained nothing synthetic. Another product contained the assurance that the herbs in the blends had been used for centuries in various places (giving a false impression of safety). I worry about possible long term effects.
Salvia divinorum	With Salvia Divinorum I've experienced brief moments (during what is essentially an ego death experience) in which I feel as though my personality has completely disappeared, never to return. However, just as panic is about to set in the feeling of normality begins to return and any anxiety tends to give way to a feeling of contentment. This 'loss of ego' reminds me of what transcendental buddhists describe as 'oneness' with the world around us - something I've never been able to achieve with regular meditation. In this regard, the loss of ego is not necessarily a negative thing.
	Salvia was a shocking and unpleasant experience.

3.4.18 Patterns of use of new psychoactive substances

Table 3.25 presents a comparison of powders, pills and 'liquid highs', smoking blends and ethnobotanicals in terms of the company that respondents are likely to be with when using these substances. As can be seen, the use of 'legal highs' in general seems most likely to occur when the drug user is in the company of friends.

The use of 'legal high' powders and party pills/'liquid highs' appears to be more likely when drug users are with friends than when they are with any other social group, or alone. In total, 202 (96%) respondents reported using 'legal high' powders and party pills/'liquid highs' with friends, and of these, 127 (60.2%) used these substances only when they were with friends [n = 211]. Eighteen respondents (8.5%) reported using 'legal high' powders and party pills/'liquid highs' when they were alone, and four (19%) of these reported typically only using these substances when they were alone. However, among all the types of new psychoactive substances studied, powders appear least likely to be used when the drug users are alone.

Table 3.25 Company when using new psychoactive substances*

Company	Percentage of respondents		
	Powders, pills, and liquid highs	Smoking blends	Ethnobotanicals
With acquaintances	30% (63)	30% (53)	11.3% (11)
Alone	8.5% (18)	20.1% (38)	15.5% (15)
With family	9% (11)	9.8% (18)	8.2% (8)
With friends	96% (202)	96% (175)	89% (86)
With strangers	13.7% (29)	9.8% (18)	4.1% (4)
n	**211**	**183**	**97**

* Multiple choice answer options were available to respondents.

Table 3.26 summarises the settings where various 'legal highs' are used. The use of powders, party pills and 'liquid highs' appears greatest in social settings such as parties, clubs and festivals. As these types of 'legal highs' typically mimic the effects of 'club drugs' such as ecstasy, MDMA and cocaine, it is unsurprising to note an association with venues involving music and dance. Both smoking blends and ethnobotanicals appear more likely to be used in private dwellings, such as one's own home or a friend's home. The use of these substances may be less easily concealed than that of powders and pills. The differing settings of use may reflect the type of 'high' or effects expected by those using the substance. Notably, the use of ethnobotanicals, the effects of which are associated with intense hallucinogenic and dissociative effects, is less likely to occur in public venues.

Table 3.26 Settings for use of new psychoactive substances*

Location	Percentage of respondents		
	Powders, pills, and 'liquid highs'	Smoking blends	Ethnobotanicals
At a friend's home	72% (151)	82% (150)	68% (66)
At a gig	45% (95)	0% (0)	0% (0)
At work	3% (6)	4.9% (9)	0% (0)
Festival	60.1% (128)	43.2% (79)	33% (32)
In a bar	43% (90)	22% (40)	11.3 (11)
In a club	67% (141)	20% (36)	8.2% (8)
In your own home	49.3% (104)	62.3% (114)	56% (54)
Party	83% (174)	63.4% (116)	36.1% (35)
n	**211**	**183**	**97**

* Multiple choice answer options were available to respondents.

Other settings for use of powders, pills and 'liquid highs' included the street, school, St Stephen's Green park, and 'driving a car'.

Use of powders, pills and 'liquid highs' appears to occur most frequently on Friday evenings and Friday nights and Saturday nights (see Table 3.27).

Table 3.27 Use of powders, party pills and 'liquid highs' by day of week and time of day

Day	Time of day			
	Evening	Night	Morning	Afternoon
Monday	8.2% (18)	12.7% (28)	4.1% (9)	3.6% (8)
Tuesday	3.2% (7)	12.2% (27)	3.2% (7)	3.6% (8)
Wednesday	10% (22)	15.8% (35)	3.6% (8)	2.7% (6)
Thursday	11.3% (25)	18.1% (40)	3.2% (7)	3.6% (8)
Friday	**33% (73)**	**78% (172)**	1.4% (3)	9.5% (21)
Saturday	10% (22)	**79% (174)**	17.2% (38)	23.1% (51)
Sunday	15.8% (35)	24% (53)	19.5% (43)	19.9% (44)

* Multiple choice answer options were available to respondents. n = 221.

Similarly, the use of smoking blends and ethnobotanicals was most frequently reported for Fridays and Saturdays, as is highlighted in Table 3.28.

Table 3.28 Use of smoking blends and ethnobotanicals by day of week

Day of week	Percentage of respondents	
	Smoking blends	Ethnobotanicals
Monday	34.5% (68)	10.3% (13)
Tuesday	36.5% (72)	10.3% (13)
Wednesday	38.1% (75)	12.7% (16)
Thursday	44% (86)	15.1% (19)
Friday	**71.1% (140)**	**52.4% (66)**
Saturday	**72% (141)**	**52.4% (66)**
Sunday	42.2% (93)	26.2% (33)
n	**197**	**126**

3.4.19 Polydrug use

When asked what substances they are most likely to use together in one session, respondents identified 37 different substances in total. The substances and the occurrence in the question responses are listed in Table 3.29. As can be seen, the use of illegal drugs among survey respondents appears to be common.

Table 3.29 A list of substances most likely to be used together in one session by survey respondents*

Substance	Percentage of respondents
Alcohol	87% (224)
Tobacco	46% (118)
Ecstasy****	35.3% (91)
Cannabis****	70.1% (181)
Cocaine****	28.3% (73)
BZP***	23.3% (60)
Mephedrone***	23% (59)
MDMA crystals	11.2% (29)
Ketamine***	8.9% (23)
Amphetamine (speed)****	5.8% (15)
LSD****	4.7% (12)
Magic Mushrooms****	4.7% (12)
*Salvia divinorum***	3.9% (10)
Methylone***	1.6% (4)
'White Columbia'**	1.6% (4)
'Diablo'**	1.2% (3)
Crack****	0.8% (2)
Heroin****	0.8% (2)
Kratom**	0.8% (2)
Methadone	0.8% (2)
2-Ai**	0.8% (2)
Amyl Nitrate****	0.4% (1)
Butylone***	0.4% (1)
'Charge'***	0.4% (1)
DMAA**	0.4% (1)
'Doves'***	0.4% (1)
'Enchanted'**	0.4% (1)
'Go-E'**	0.4% (1)
'Iced Diamonds'**	0.4% (1)

Table 3.29 A list of substances most likely to be used together in one session by survey respondents* (continued)

Substance	Percentage of respondents
MDAT**	0.4% (1)
Methamphetamine****	0.4% (1)
'Mitzies'***	0.4% (1)
Naphyrone**	0.4% (1)
Nitrus Oxide	0.4% (1)
'Pink Champagnes'**	0.4% (1)
'Raz'**	0.4% (1)
'Star Dust'**	0.4% (1)
'Whack'**	0.4% (1)
n	**258**

* Multiple choice answer options were available to respondents.

** 'Legal highs' (July 2010).

*** Former 'legal highs' (before May 2010), which are referred to as 'legal highs' for the purposes of this section of the report.

**** Illegal substances before May 2010.

An analysis of the number of substances likely to be combined within one session revealed that the mode is three (30.1% [78]) [n=259]. With alcohol and tobacco omitted, the mode is one (33.5% [85] [n=254]. The lack of frequency with which 'legal highs' were reported in likely combinations is notable, with approximately a third of respondents (32.4% [83]) listing a 'legal high' [n=256]. In total, 16 'legal highs' were identified within the likely combinations. Those who listed a 'legal high', listed between one and three types, with most listing one (26.5% [67]) [n=256]. Mephedrone was the most popular, with 65.1% (54) of those who listed a 'legal high' [n = 83], counting it as likely to be consumed in combination with other substances.

It appears that respondents are more likely to combine alcohol and tobacco with illegal drugs in a session than to combine alcohol and tobacco with 'legal highs' in a session. With the exclusion of alcohol and tobacco, the combination of cannabis, ecstasy and cocaine was the most commonly reported, with 15.5% (40) [n = 258] of individuals using these three together, some combining them with other substances, notably MDMA, ketamine and mephedrone.

The substances mostly likely to be combined with mephedrone were alcohol, by 78% of respondents (42), cannabis by 65% (35), ecstasy 46% (25) and cocaine 39% (21) [n = 54]. A minority of respondents reported the likelihood of combining mephedrone with multiple substances in the one session, as follows:

- Cannabis, ecstasy, cocaine, MDMA, ketamine (1.9% [1])
- Cannabis, ecstasy, cocaine and ketamine (7.4% [4])
- Cannabis, ecstasy, cocaine and MDMA (5.6% [3])
- Cannabis, ecstasy and cocaine (7.4% [4])
- Ecstasy and cocaine (7.4% [4])
- Cannabis and cocaine (3.7% [2])

Cannabis, ecstasy and cocaine appear to be the most popular combinations with mephedrone (after alcohol). 'Legal highs' reported as likely to be used together with mephedrone are methylone 1.9% [1]), butylone (1.9% [1]), and 2-Ai (1.9% [1]).

When asked what two substances respondents were most likely to combine (excluding alcohol and tobacco), it appears that cannabis and ecstasy were the most likely combination (11.3% [23]), followed by ecstasy and cocaine (8.4% [17]) [n = 204].

3.4.20 Access to new psychoactive substances

Respondents were asked about where they have sourced new psychoactive substances. Their responses are summarised in Table 3.30.

Table 3.30 Respondents' source of new psychoactive substances*

Source	Percentage of respondents
Acquaintances	23.4% (61)
Dealer	15.3% (40)
Family	3.8% (10)
Festival stall	2.7% (7)
Friends	66% (171)
Head shop	78% (203)
Home delivery service	2.7% (7)
Online outlet	16.5% (43)
n	**261**

* Multiple choice answer options were available to respondents.

Head shops were most often reported as a source of new psychoactive substances for respondents. The proximity of head shops to users' homes is likely to facilitate this. As can be seen in Table 3.30, 65% (146) of respondents have access to a head shop within 5km of their home [n = 203]. 'Legal highs' were sourced online by 16.5% (43) of respondents and were sourced from a 'dealer' by 12.2% (40) [n = 261]. Seven respondents (2.7%) obtained 'legal highs' through a home delivery service.

Table 3.31 Distance between home and head shop of those who have purchased new psychoactive substances from a head shop

Distance	Percentage of respondents
Less than 1km	21.7%(44)
Between 1km and 2km	19.7% (40)
2km to 5km	24% (48)
Between 5km and 10km	14% (28)
10km or more	21.2% (43)
n	**203**

The majority of respondents (94% [226]) typically spend less than €50 on new psychoactive substances in one transaction [n = 242]. Nine respondents (3.7%) spend between €50 and €100. Two respondents (0.8%) spend in excess of €150, with one (0.4%) spending €500 to €1,000 in one transaction

More respondents reported finding out about new psychoactive substances from friends (81.3% [213]) than from any other possible source [n = 262]. The second most common source of information was identified as head shops (45.4% [119]). A breakdown by main sources is available in Table 3.32.

Table 3.32 Respondents' source of information about new psychoactive substances*

Source	Percentage of respondents
Acquaintances	23.1% (76)
Friends	65% (213)
Head shops	36.2% (119)
Internet forums	22.5% (74)
Magazines	7% (23)
Newspapers	12.3% (40)
Online outlets	9.1% (30)
Radio	8.3% (27)
Social networking sites	7.6% (25)
Television	9.2% (30)
YouTube	2.3% (7)
n	**262**

* Multiple choice answer options were available to respondents.

3.4.21 Reason for use of new psychoactive substances

Respondents were asked to indicate the extent to which various factors influenced their decision to use new psychoactive substances. Responses are presented in Tables 3.33a and 3.33b.

Table 3.33a Factors influencing respondents' decision to use new psychoactive substances

Factor	n	Not at all	Very little	Unsure	Somewhat	Very much
They are safer than legal drugs	258	48% (126)	14.7% (38)	15.5% (40)	17.1% (44)	3.9% (10)
They are better quality product than legal drugs	256	44.5% (114)	13.3% (34)	14.1% (36)	18% (46)	9.8% (25)
You get a better 'high' than from the illegal alternative	254	47% (118)	17.3% (44)	13.8% (35)	12.6% (32)	9.5% (24)
You get a more consistent product	255	34% (85)	12.5% (32)	13.4% (34)	22.7% (58)	13.7% (35)
You are less likely to get unwanted side effects	254	53.5% (136)	9.8% (25)	13% (33)	14.2% (36)	5.1% (13)

From the data presented in Table 3.33a it can be seen that many respondents claimed not to be influenced by perceptions of 'safety' or 'quality' of 'legal high' powders and party pills. Within the options presented to respondents, consistency of product appears to be the most influential factor. It must be noted, however, that three survey respondents emailed the researchers in relation to factors impacting the decision to use 'legal highs' and all felt that the availability of substances was a key consideration.

It can be seen from Table 3.33b that curiosity was rated by 41.8% (104) of respondents as 'very much influencing their decision' to use new psychoactive substances and by 46.2% (115) as 'somewhat influencing their decision'. Curiosity thus appears to be strongly implicated in determining respondents' decision to use new psychoactive substances. About half the respondents appeared to be influenced to some extent by friends or siblings, while the other half appeared to be influenced very little, or not at all by this. Few respondents reported being influenced by a perceived lessened possibility of detection in drug screening.

Table 3.33b Factors influencing decision to use new psychoactive substances

Factor	n	Very much	Somewhat	Unsure	Very little	Not at all
Curiosity	249	41.8% (104)	46.2% (115)	2% (5)	2.8% (7)	7.6% (19)
Having nothing else to do	245	9% (22)	27% (66)	7.4% (18)	19.2% (47)	38% (93)
To reduce stress	245	8.6% (21)	25.7% (63)	5.7% (14)	19.2% (47)	41.6% (102)
To escape	246	13.8% (34)	23.2% (57)	7.7% (19)	12.6% (31)	43.1% (106)
My friends or siblings were doing it	246	11.8% (29)	35% (86)	6.9% (17)	15.1% (37)	31.7% (78)
I think they are less easily detected in drug screens than illegal drugs	245	4.5% (11)	4.5% (11)	8.2% (20)	9.4% (23)	74% (181)
I think they are less easily detected by sniffer dogs	247	3.2% (8)	3.6% (9)	7.3% (18)	8.5% (21)	77.7% (192)

The findings of the online survey will be discussed following presentation of findings from the qualitative interviews.

3.5 The experiences of 'recreational' users of new psychoactive substances

Brief semi-structured interviews were conducted with four users of new psychoactive substances. All had a history of use of ecstasy, LSD, cannabis and magic mushrooms. Three had used cocaine, two regularly. Three had a history of amphetamine use.

Products used

Participants reported the use of a range of new psychoactive substances, notably those in powder form, party pills and, to a lesser extent, smoking blends. Two participants were regular users of powders at the time the interviews were conducted. The substance of choice had been mephedrone ('Wild Cat', 'Pure Gold'), but other powders were also used pre-ban (May 2010), especially methylone. Since the ban, use shifted from mephedrone to other available powders, such as 'Pure NRG', 'Duffy's Hysteria', 'Amplified' and 'White Columbia'. Party pills use was reported by all users, with regular use reported by two respondents. It was common for participants not to know the names of the party pills they had taken, although all reported the use of BZP. Two participants had regularly used the smoking blends, in particular 'Sky High', 'Spice" and 'Zohai'. The use of ethnobotanical substances appeared to be minimal. However, all participants had taken magic mushrooms, and three had tried *Salvia divinorum*.

Quantity, mode and frequency of use

Powders were typically snorted by users, but 'bombing', baking into a cake, and dissolving in tea were also reported. Where snorting was avoided, this was typically to avoid discomfort to the nasal passage. Substances might also be dissolved in tea to avoid possible damage to the stomach if the substance e.g. 'Amplified' [RI2] was particularly harsh. Party pills were typically swallowed whole; smoking blends were smoked in a joint or bong; and *Salvia* was smoked in a bong, or made into a tea. None of the participants had ever injected a substance.

Use of powders varied between one half, to one and one half grams in a typical session; the maximum consumed being three grams in a session. Regular users of party pills typically took pills together and might combine these with a few joints made from cannabis or from a 'legal' smoking blend. One participant typically combined approximately one half gram of a powder, two party pills and a number of joints on a night out. Another participant, who no longer uses substances regularly, reported combining powders and party pills with cocaine or ecstasy, cannabis, alcohol, and at times *Salvia*, over the course of one session. The typical substance combinations reported by users were powders or pills with cannabis or smoking blends. Two participants reported never using alcohol with new psychoactive substances, preferring instead to have water, fruit juice or a soft drink.

For all participants, the use of new psychoactive substances was mostly confined to weekends; for three of the participants, it was linked to social situations. Parties, pubs, festivals and clubs were all cited as venues where powders or pills might be consumed by participants. Smoking was also linked to the home, and to friends' homes. For all but one participant, the use of new psychoactive substances seemed to be characterised as a group activity. This individual typically used powders while at home alone, watching television, surfing the Internet or playing music.

Participants reported engaging in behaviours intended to minimise the potential damage or discomfort from using substances. In addition to avoiding alcohol, drinking water and bombing or dissolving substances to avoid the nasal passage, participants reported researching substances online, staged dosing, and one individual reported regularly dousing their nose with water when snorting.

Desirable effects

Three participants noted positive experiences overall as a result of using new psychoactive substances. As mentioned earlier, mephedrone was cited as a pleasurable drug, and was described by one participant as follows:

> 'Basically like a coke, or E high. Burst of euphoria, talkativeness, well-being that levels out into a good sense of stimulation, like a wiredness' [R1].

In comparison, 'Pure NRG' was described as similar to mephedrone, but 'a little more overwhelming and euphoric' [R1]. Both reportedly compare very favourably with cocaine. As with previous research (e.g. Mixmag, 2010), sexual arousal and increased sexual drive was associated with mephedrone and this was considered a positive effect. BZP was generally reported as the party pill of choice, with those pills that have emerged since not giving the same level of satisfaction. The desirable effects of smoking blends, notably 'Sky High' were generally considered to be favourable and very similar to the effects of cannabis, though achieved at larger quantities. According to one participant:

> 'Some of the smoking blends were certainly like a cannabis high, but you would have to use a good quantity to get the same effects … Like 'Sky High' – the similarity was striking – it was almost like you were smoking some cannabis' [R3].

Despite the noted desirable effects, all participants felt that the effects of illegal drugs such as cocaine, ecstasy, amphetamine and cannabis are more pleasurable than the effects of their 'legal' counterparts. According to one:

> 'It's not the same standard of high as you're going to get from the illegal stuff' [R3].

Another participant commented as follows:

> 'They're ['legal highs'] all a bit strange. They make you feel wonky … Legal highs are more bizarre, less enjoyable and more nasty [than illegal drugs]' [R4].

Unwanted effects

Dehydration, palpitations and insomnia were all associated with new psychoactive substances in powder form. Insomnia in particular was noted as a characteristic effect, and this was reported to last for up to three nights after use.

As noted in previous research (e.g. Van Hout and Brennan, in press, a) a peculiar taste and smell was linked to mephedrone for two participants in this study. One commented:

> 'Meow Meow [mephedrone]. You can tell it was very toxic – you just knew it was very, very toxic. The taste was horrendous, the hit was bizarre – not particularly good [R4].

Harsh effects of 'Amplified' were noted by one participant:

> '[Amplified] burnt the upper nose. It was really unpleasant and it would take seven to ten days for you to stop coughing up blood – well maybe it wasn't blood, but it was red phlegm' [R2].

Smoking blends were linked to anxiety and paranoia both during use and after use and this contrasted with the effects from cannabis reported by one participant:

> 'Some of my friends have experienced very intense anxiety and paranoia as well, that funny enough, they wouldn't expect with marijuana' [R3].

Effects of *Salvia divinorum* were described as intense, and tended to involve dissociative and hallucinogenic experiences which were described as 'frightening' or 'like a nightmare' by participants. Their reactions appeared to be linked to a lack of expectation for the actual effects experienced, or for their intensity. Despite such initial experiences, two participants went on to use *Salvia* again, with less distressing results. One commented that in the right environment and with the right company it can be a pleasurable experience.

In addition to insomnia, come-down effects from powders were described as severe by the two regular users; these effects included tiredness, twitching and spasms, as well as anxiety and paranoia at times.

> 'Insomnia, anxiety and elements of paranoia if you over done it. Not sleeping is a factor with regard to anxiety' [R2].

Both agreed that insomnia plays a role in the negative come-down experience. Come-downs are also generally considered worse than those associated with illegal drugs, with the exception of ecstasy for one user:

> 'The come-down is bad – like all come-downs. Worse than cocaine, not as bad as ecstasy. Wired, tired and washed-out. But I never had the depressed feeling from legal highs [that I get from ecstasy]' [R1].

The duration of the come-down varies, but negative effects are reported to diminish once the individual has slept. Paranoia and anxiety were also reported as possible during the come-down from smoking blends. In order to deal with come-down effects, participants reported trying to get sleep, eating a meal and consuming fluids and 'healthy' foods such as yogurt.

Despite the range of negative effects experienced by participants, all considered the use of substances ('legal' and illegal) to be 'worth it'. Only one felt his experiences with new psychoactive substances (mephedrone in particular) would deter him from using them again. Overall, participants were agreed on their preference for illegal drugs such as cocaine, ecstasy, amphetamine, MDMA and cannabis. Three also noted that since the Government ban in May 2010, they had returned to using illegal drugs and intended to continue doing so. One noted a newly emerged trend among his friends to purchase illegal substances in large quantities (stockpile) in order to minimise the perceived risks associated with purchasing drugs from dealers.

3.6 Discussion

Male survey respondents outnumbered female respondents by a ratio of approximately 2:1, consistent with previous online surveys of users of new psychoactive substances in the UK (e.g. Mixmag, 2010; Schmidt and Butler, 2009). Respondents in the current study were most likely to be living in urban areas and currently in third-level education. As the study involved a self-selected convenience sample, the data do not reflect the use of these substances in the wider population. Therefore the extent to which generalisations can be made from the findings is limited. Instead, a cross-section of the particular user group is presented. This is complemented with qualitative data from four users of new psychoactive substances.

The survey findings indicate a pattern of infrequent recent use of new psychoactive substances among respondents. This may reflect a shift in use in response to the Government ban on a range of substances in May 2010 and the subsequent closure of many head shops. Indeed, data indicated a shift in pattern of use away from new psychoactive substances and a return to illegal drugs such as cocaine and cannabis in the wake of the ban.

Despite recent infrequent use, an extensive range of different powders, party pills/'liquid highs' and ethnobotanical substances had been sampled by participants. Unsurprisingly, among powders and pills, more pre-ban (May 2010) substances had been sampled than post-ban substances. Among products that became available post-ban, 'Whack', 'Pure-NRG', 'White Columbia', 'Charlie Chalk', 'Rush' and 'Star Dust' were reported as having been sampled. Less frequent were reports of 'Amplified' and 'Raz', with 'Ivory Wave' reported by just one respondent. A number of post-ban 'next generation compounds' as identified by Kavanagh and colleagues (2010e) appeared in survey responses, including 2-Ai, 5-iAi, 'Benzo Fury' and MDAI.

Similar to findings from previous studies (e.g. Mixmag, 2010; Van Hout and Brennan, in press, a,b), mephedrone appears to have been the most popular powder by far among survey respondents, and among the interview participants. In the case of party pills, the use of BZP was reported by 17.9% of all respondents and by more than two-thirds of those who have tried party pills. More individuals had tried smoking blends than any other type of new psychoactive substance and, in the case of the smoking blends category, the use of 'Smoke XXX' was reported most often. Among ethnobotanicals, *Salvia divinorum* was most popular, being sampled by almost a quarter of all respondents, which was similar to findings from the Mixmag (2010) study.

When asked what substances respondents are likely to combine in one session, excluding alcohol and tobacco, illegal substances predominated and new psychoactive substances were less frequently reported. The use of illegal drugs, especially cannabis, ecstasy and cocaine thus appears very common among those surveyed. These drugs are likely to be used in combination together, or with other substances including MDMA and ketamine. Indeed, the EMCDDA (2009) recently noted that it is rare for individuals to restrict their substance use to one type alone. As reported elsewhere, (Mixmag, 2010; Schmidt and Butler, 2009; Van Hout and Brennan, in press, b), new psychoactive substances are likely to be mixed with cannabis, cocaine and ecstasy, thus exposing users to the risks associated with polydrug use. The use of substances in combination was also reported by interview participants.

Although mephedrone became a controlled substance in May 2010, respondents reported the likelihood of using mephedrone together with other illegal drugs more often than they did any other 'legal high'. Anecdotal reports suggest mephedrone can be purchased for €40 a gram on the illegal drugs market (August 2010) and that it is being purchased via the Internet for personal use. Indeed, the researchers unintentionally purchased mephedrone over the Internet during the course of the current review. As observed in previous research (Mixmag, 2010; Van Hout and Brennan, in press, a) cannabis, ecstasy and cocaine are most likely to be combined with mephedrone, after alcohol and tobacco.

Subjective negative effects appear to be more commonly experienced with powders than with party pills. Palpitations in particular seem to be extremely worrying for many, as reflected in their personal comments. Fear, anxiety, distress and panic were also reported by users of both powders and pills. Memory loss and blackouts appear associated with powders, with 36% of users reporting these effects. This finding is consistent with previous research which identified experiences of amnesia related to mephedrone use (Newcombe, 2009). Participants in Newcombe's study did not appear to be very concerned about this amnesia. Similarly, nearly 40% of those reporting memory loss/blackouts in the current study reported expecting this effect. While some people appear to expect negative effects as a result of consuming psychoactive substances, it appears that many people may not. This lack of expectation may contribute to the experience of discomfort or distress, as appears to have been the case with interview participants ho tried *Salvia divinorum*.

Many survey respondents do not appear to engage in behaviours intended to minimise the likelihood of negative effects. Previous research in the Irish context (Van Hout and Brennan, in press, b) found 'gauging' to be more common among more experienced drug takers, with younger ones tending to be more 'reckless'. Similar to the current study, Van Hout and Brennan (in press, b) found that instructions on packaging are unlikely to be heeded. Instead, it was suggested that users of new psychoactive substances rely on experience, common sense and their own trusted measures, such as drinking water (Van Hout and Brennan, in press, b). Similarly, interview participants, who were all experienced drug takers, engaged in various behaviours, such as staged dosing and the avoidance of alcohol, in order to minimise potentially adverse effects.

Come-down effects from powders and pills were experienced by both survey respondents and interview participants, and included insomnia and palpitations. Mental health issues, which ranged from low mood and anxiety to suicidality, were also reported. With regard to smoking blends and ethnobotanicals, an analysis of users' comments revealed that in addition to palpitations, there were reports of anxiety and paranoia, particularly in relation to smoking blends. Similarly, one interview participant associated smoking blends with anxiety and paranoia among his friends. There were fewer specific reports of concerns in relation to ethnobotanical substances, both in survey responses and in interview data. Despite the health concerns reported by many 'legal highs' users, few seem to be accessing services as a result. The reason for this is not clear, but may reflect the presence of effective personal coping mechanisms within this group, or perhaps a reluctance to seek help due to the stigma associated with substance use.

Use of new psychoactive substances appears to be recreational among survey respondents, with the use of all types most likely to occur on Fridays and Saturdays. The substances are being used across a range of settings, with powders and pills associated with music and dance venues whereas the use of smoking blends and ethnobotanicals is more often associated with private spaces. Use is also most likely to take place while the individual is in the company of friends. Head shops, friends and acquaintances were the common sources of new psychoactive substances. Fewer respondents reported purchasing via the Internet and this contrasts with the UK where the Internet has been identified as a main source of new psychoactive substance (Schmidt and Butler, 2009). As identified among users in the UK (Newcomb, 2009; Schmidt and Butler, 2009) and in Ireland (Van Hout and Brennan, in press, b), curiosity was identified as a key reason for using new psychoactive substances. Availability also appears to be an important factor for participants in this study, as in other studies (Hasse and Pratschke, 2010; Measham *et al.*, 2010). Consistent with the findings of Measham and colleagues (2010), interview participants highlighted a shift in the use of new psychoactive substances with a return to illegal drugs, predominantly based on availability and perceived quality. This is an area that requires further exploration, particularly in light of recent legislative changes.

The research has revealed a subgroup of users of new psychoactive substances who appear to be using substances recreationally, as determined by a recent infrequent pattern of use that mostly occurs at weekends. This pattern of use does not appear to be leading to significant difficulties for the majority of users, consistent with previous research in the UK (Schmidt and Butler, 2009) and in New Zealand (Wilkins *et al.*, 2008) which noted that serious adverse effects among 'recreational' users are not common. While these users do experience negative effects as a result of use of these substances, they appear to be coping without coming into contact with healthcare professionals. It must be noted that while there is some knowledge of the short-term effects of some of the more popular substances, the effects of many substances in the medium and long term are not known. Findings have implications for the development of harm-reduction measures for this specific subgroup of users.

3.7 Conclusion

An understanding of the pattern of use of new psychoactive substances increases the likelihood that responses to the phenomenon will be appropriate. However, as legal responses are implemented, patterns will change and it is likely that there will be displacement of drug consumption choices. The route that this will take remains to be seen but it is likely to be based on factors of availability and purity and, to a lesser extent, convenience and legality (Measham *et al.*, 2010). The indications from the review research is that this indeed may be the pattern emerging in the wake of legal responses. It is important that the impact of policy and legislative changes is monitored to ensure that any new risks that may result from displacement are identified and addressed.

4 Risk factors and harm-reduction measures[37]

According to Measham and colleagues, 'accurate and context-specific harm-reduction messages are particularly important in the early days of emergent drug use, when both scientific and lay knowledge is limited' (2010, p19). The paucity of research evidence linking harms to specific compounds represents a challenge for harm reduction for users of new psychoactive substances. In the absence of such evidence, generic advice and information based on current stimulant and cannabis harm-reduction advice is recommended.

4.1 Assessment of risk

The findings of this review indicate a number of factors that need to be considered in terms of the risks posed by new psychoactive substances. Some factors apply to all users, and others to the specific subgroups of users identified in this review: problem drug users and 'recreational' drug users. The factors outlined below must also be considered alongside the specific risks associated with the use of stimulants and cannabis.

All users

- The lack of consistency between the advertised content and the actual content of some new psychoactive substance products may increase the likelihood of misuse and overdose.
- A lack of consistency in the active content of individual products over time may put users at risk of misusing the substance, or of overdosing.
- The combination of substances within individual products creates a potential risk of problematic drug interactions.
- Differing levels of purity and potency between illegal drugs (e.g. cocaine and ecstasy) and new psychoactive substances available from head shops and online means that individuals may run the risk of overdosing when switching use from illegal drugs to new psychoactive substances.
- New psychoactive substances have not been tested in clinical trials and the short-, medium-, and long-term effects are not known. The effects and harm- reduction options for other drugs (such as cannabis and heroin) are well known, as these substances have a long history of recreational use.
- There is a lack of information on the safety or toxicity of new psychoactive substances and therefore dosage information is unclear, thus potentially increasing the likelihood of overdose.
- The lack of knowledge about the toxicity and effects of new psychoactive substances may mean harm-reduction options are not always clear.
- Many new psychoactive substances are powerful stimulants and are therefore likely to have health risks such as cardiovascular toxicity associated with them.
- The lack of reference standards for new psychoactive substances means that toxicological analysis can be difficult.
- The abuse potential of many new psychoactive substances is not yet known.
- Smoking blends which may be perceived as 'herbal products' tend to be laced with synthetic psychoactive substances (e.g. cannabinoids); these substances may be more powerful than cannabis and do not contain CBD (cannabidiol), a naturally occurring antipsychotic component of the cannabis plant (Zuardi, Crippa, Hallak, Moreiral and Guimarães, 2006). Reports of anxiety and paranoia were

37 This should be regarded as preliminary risk assessment as it draws on some of the data sources suggested for new substances by the EMCDDA (2009, pp 23-24).

associated with use of smoking blends in the current study and therefore they may pose a particular risk to psychological well-being.

- As with the use of other stimulants, such as MDMA, there may be a risk of hyperthermia and dehydration associated with the use of new psychoactive stimulant drugs.
- Users of new psychoactive substances may inadvertently engage in criminal behaviour if they purchase a supposedly legal product which actually contains a controlled substance. This may especially be the case with online purchases, which have been shown to contain controlled substances, despite purporting otherwise.
- Recent changes in legislation and a subsequent reduction in the supply of new psychoactive substances will lead to displacement of drug consumption choice. The direction of this displacement may bring with it a new set of risks to consumers.
- There are anecdotal reports of the availability of formerly legal substances, such as mephedrone, on the illegal drugs market. If this is indeed the case, then it is likely that (as is the case with cocaine) there will be an increased presence of adulterants found in these substances. This will pose an additional element of risk to the user.

Problem drug users

- New psychoactive substances in powder form are being used at very high doses, thus increasing the risk of adverse effects and overdose.
- New psychoactive substances in powder form are being used daily by some users, thus increasing the likelihood of negative health outcomes.
- The route of administration (injection) poses specific risks to users, including abscesses, ulcers, infections and a risk of blood-borne viruses, if safer injecting practices are not adhered to.
- Reports from users indicate that some new psychoactive substances in powder form are not easily injected, may clog in the vein, or create an acid-like burning sensation on the skin. Users may also need to use larger needles in order to inject themselves. These factors may lead to more damage to the vein and also to the injection site.
- New psychoactive substances in powder form (notably 'Amplifier') are reported by users to be of very high strength. Consequently, users are wary of their use. The reported potency may increase the potential for adverse reactions.
- There appears to be an association between the use of new psychoactive substances in powder form and the appearance of psychotic symptoms among problem drug users. This link was highlighted by service providers and substance users themselves.
- User reports of compulsive re-dosing and tolerance effects are indicative of the abuse potential of new psychoactive substances in powder form.
- The use of new psychoactive substances in powder form appears to have led to a change in pattern of use of heroin among problem drug users. It appears common for individuals to mix 'powders' and heroin together in one dose, and to use heroin and 'powders' interchangeably in order to cope with the negative effects of each one. A reduction in heroin use does not appear to have occurred. As previously noted, the extent and implications of this pattern of use have yet to be fully understood.
- Problem drug users with an existing mental health condition may be at particular risk of negative psychological effects associated with the use of new psychoactive substances in powder form.

- Reports from service providers highlight the potential risk posed by the possible abandonment of safer injecting practices by users.
- Problem drug users may spend a large proportion of their money (in some cases all their money) on new psychoactive substances in powder form. They may also run the risk of losing emergency accommodation as a result of their use of these substances.
- The product 'Amplified' or 'Amplifier'[38] has been identified as a particular difficulty among problem drug users. Dimethocaine has been identified as the psychoactive compound in the product 'Amplified' (Kavanagh *et al.*, 2010b, 2010c, 2010d, 2010f); it is controlled under the legislation set out in Irish Medicines Board Act 1995. The availability of this drug on the illegal drugs market should thus be monitored.

'Recreational' drug users

- A consistent finding is that males are at least twice as likely as females to use new psychoactive substances.
- More severe adverse effects of new psychoactive substances have been reported in females and have been attributed to differences in body weight between males and females (Wilkins *et al.*, 2008).
- Specific health effects are associated with the use of new psychoactive substances in powder form. In particular, powders have been associated with memory loss, blackouts and amnesia. Mental health effects experienced as fear, anxiety, distress, panic, paranoia and delusions have been reported. Palpitations also appear to be commonly experienced. Findings from the survey undertaken as part of this review are summarised in Table 4.1.

Table 4.1 Health effects during use of 'legal high' powders

		Experienced	
Effect	**n**	**Yes**	**No**
Palpitations	167	67.7% (113)	29% (54)
Chest pain	155	16.8% (28)	83.2% (129)
Breathing difficulties	154	19.5% (30)	80.5% (124)
Fear, anxiety, distress, panic	161	40.4% (65)	59.6% (96)
Paranoia/delusions	158	38% (60)	62% (98)
Aggression	158	19% (30)	81% (128)
Memory loss/blackouts	160	42.5% (68)	57.5% (92)
Fainting/collapse	152	4.6% (7)	95.4% (145)

- Specific health effects associated with party pills/'liquid highs' are summarised in Table 4.2. Reports of fainting/collapse appear to be associated with party pills. The setting may play a role, as the use of these products is associated with dancing endurance and thus possible dehydration and exhaustion. As with powders, palpitations appear to be commonly experienced.

38 The difficulty with interpreting references to the product 'Amplifier' have been noted in Section 3.

Table 4.2 Health effects during use of party pills/'liquid highs'

		Experienced	
Effect	**n**	**Yes**	**No**
Palpitations	111	61.3% (68)	38.7% (43)
Chest pain	101	15.8% (16)	84.2% (85)
Breathing difficulties	98	11.2% (11)	88.8% (87)
Fear, anxiety, distress, panic	104	39.4% (41)	60.6% (63)
Paranoia/delusions	104	35.6% (37)	64.4% (67)
Aggression	97	13.4% (13)	86.6% (84)
Memory loss/blackouts	102	27.5% (28)	72.5% (74)
Fainting/collapse	96	6.3% (6)	93.8% (90)

- Mental health effects appear to be experienced during the come-down from new psychoactive substances (Table 4.3).

Table 4.3 Come-down effects associated 'legal high' powders, party pills and/or 'liquid highs'

		Experienced	
Effect	**n**	**Yes**	**No**
Insomnia	170	73.5% (125)	24.7% (42)
Low mood, sadness, depression	170	71.8% (122)	27.6% (47)
Fear, anxiety, distress or panic	163	44.2% (72)	54.6% (89)
Paranoia/delusions/hallucinations	157	33.1% (52)	66.2% (104)
Palpitations	159	47.2% (75)	52.2% (83)
Chest pain	153	20.9% (32)	76.5% (117)
Breathing difficulties	155	18.7% (29)	77.4% (120)

- 'Recreational' users report experiencing health concerns associated with new psychoactive substances in powder form, 'party pills' and 'liquid highs'. Findings from the current study are summarised in Table 4.4.

Table 4.4 Health concerns in relation to 'legal high' powders, party pills and/or 'liquid highs'

Health concern/behaviour	**n**	**Yes**	**No**	**I'm unsure**
Concerns for physical health	198	46% (91)	52% (103)	2% (4)
Concerns for mental health	194	41.2% (80)	56.2% (109)	2.6% (5)

- 'Recreational' users report experiencing health concerns in relation to the use of smoking blends/ethnobotanicals. Findings from the current study are summarised in Table 4.5.

Table 4.5 Health concerns in relation to use of smoking blends and/or ethnobotanicals

Health concern/behaviour	n	Yes	No	I'm unsure
Concerns for physical health	202	33.2% (67)	64.4% (130)	2.5% (5)
Concerns for mental health	202	27.7% (56)	67.8% (137)	4.5% (9)

- 'Recreational' users are using new psychoactive substances in conjunction with other substances, notably alcohol, cannabis, cocaine and ecstasy. Polydrug use poses additional risks to the health of users.
- The practice of taking 'unknown' substances may expose users to negative health effects.
- The extent to which 'recreational' users engage in behaviour intended to minimise harm is unclear. It appears that some users (particularly less experienced individuals) do not take measures to test the strength and effects of products on commencement of use, or other measures to minimise the likelihood of adverse effects.
- Route of administration for powders is frequently insufflation (snorting). Sharing a 'tooter'[39] may increase the risk of spreading infection.

The current review provided insight into aspects of the situation at a specific point in time. The points outlined above therefore cannot be considered a comprehensive assessment of risk factors. Given the nature of the phenomenon, it is likely that new risks will appear according as new substances emerge.The situation is in flux in the wake of new legislation and therefore the monitoring and assessment of the impact of legislative changes is advised.

4.2 Suggested harm-reduction measures

The use of new psychoactive substances appears to be a new frontier in the emergence of a more risk-taking society. The toxicological and metabolic impacts of these chemicals on the drug taker are still largely unknown, and research has only recently begun to be mobilised. Therefore, specific harm-reduction measures are being developed in the context of a knowledge vacuum. In this section we focus primarily on broad social measures rather than on specific advice. Innovations in harm reduction are underway at the time of writing: the main principle of harm-reduction advice, such as that being given currently by many agencies in the field, is that if a person is unaware of the risks, they should weigh up the risk, either desist or take a test dose, and follow risk-reduction procedures, such as never taking new psychoactive substances while alone.

Primary prevention – all users

The National Drug Awareness Campaign has recently been launched. The HSE has also launched an information campaign focused on new psychoactive substances. The latter campaign provides specific advice to users in relation to minimizing risk to themselves and to their health. The findings of the review team's research broadly endorse this approach as a primary prevention strategy for the population as a whole, irrespective of their risk for drug experimentation. In addition, both the National Drug Awareness Campaign and HSE information act as a key resource for parents and those involved in a caring or educational role with children and young people.

39 A 'tooter' is an implement, such as a rolled-up bank note, or cut-off straw that is used to snort a substance.

Secondary prevention in the 'recreational' drug scene

The review group's findings also endorse the need for a secondary prevention approach, given the relationship between the new psychoactive substances, ,recreational scenes and online communication. In this context, a number of broad secondary measures focusing on key groups at particular risk are appropriate:

The development of localised guidelines for good practice in harm reduction in the night time leisure scene along the lines of those developed in the City of London (London Drug Policy Forum, 2008).[40] This approach requires collaborative efforts involving health services, drug task forces, harm-reduction agencies, entertainment industry interests, police and the emergency services.

The provision of information, training and harm-reduction activities in pubs and clubs, together with the promotion of safer clubs involving constructive engagement with club owners.

Given that the new psychoactive substances scene is also part of a general trend towards the emergence of online communities of interest, it points to the need for innovative approaches to this new phenomenon. The findings of this report and others appear to give support to measures to enable the development of non-invasive and non-directive outreach work in online spaces for the purposes of harm reduction, such as in chat boards, Facebook and so on. These measures might also require international collaboration on a European or regional scale.

Problematic users

The review group's research with problem drug users, and the agencies that work with them, identified a range of risk behaviours associated with this group. A key risk here continues to be the practice of injecting new psychoactive substances as an alternative to, or in addition to, the usual drug of choice. The new risk taking by drug users reported by harm-reduction agencies has underlined the concomitant risk that this may result in a regression in safer use practice. As already outlined, a public health challenge is to contain the incidence of blood-borne viruses. The harm-reduction strategies suggested for this group are outlined below.

- The continuation and extension of outreach activities by agencies working with problematic drug users.
- The promotion of safer injecting practice in current harm-reduction practice and, if necessary, to extend these facilities to include greater access to medical back-up and advice to staff and users. This might also include extending opening hours of such services, if such a measure is practicable.
- Supporting harm-reduction agencies in making available appropriate and specific harm-reduction information and advice, such as that developed by the Ballyfermot Local Drugs Taskforce and the Ana Liffey Drug Project.41
- The provision of training for staff in harm-reduction agencies in both State and non-State organisations.
- Closer liaison between health services, emergency services and harm-reduction agencies.
- The promotion of peer-to-peer education in harm reduction among problematic drug users.

40 London Drug Policy Forum (2008). *Safer Nightlife. http://www.cityoflondon.gov.uk/NR/rdonlyres/E4E0FE3A-9F8E-4182-AFBF-31C83E74C03A/0/SS_LDPF_safer_nightlife.pdf* Accessed 28 September 2010.

41 *http://www.aldp.ie/uploads/resources/BangingUpCoke.pdf*
http://www.aldp.ie/uploads/resources/bangingcokeposters.pdf
http://www.aldp.ie/uploads/resources/Legal_highs_and_headshops_leaflet.pdf

4.3 Key co-ordinating measures in relation to information and knowledge exchange

Policy and practice development

In the context of the speed at which the new psychoactive substances issue has emerged, it is hardly surprising that there is a general lack of process evaluations of harm-reduction interventions, practices and policies. It follows our consultations with key agencies that such a measure is required to enable the sharing of information between agencies and as a resource for the development of a wider policy framework in State agencies.

National drug strategy as an implementation framework

The network of Regional and Local Drugs Task Forces provides an existing framework for the development and implementation of the secondary and tertiary preventive and harm-reduction measures outlined above. The strategy is a proven vehicle for innovative approaches and for the mobilisation of community resources at local level. However, there appears to be a need for focused and concerted efforts on city centres, particularly Dublin, where there is an intersection between night-time leisure activity and drug taking.

5 Reference standards for chemical analysis of new psychoactive substances

The identification of new psychoactive substances requires reference standards against which samples can be compared. Reference standards and scientific literature are frequently not available for new psychoactive substances, making their identification extremely difficult. Reference standards are certified samples of the highest quality and purity, and thus tend to be very costly. If the reference standard is for a controlled substance, a special licence will also be required in order to acquire and possess it.

In the absence of reference standards, it is possible for researchers to synthesise or purify samples to serve as reference standards. For example, Kavanagh and colleagues (2010f) synthesised naphyrone, benzedrone and buphedrone, all of which are new psychoactive substances. However, substance samples must be analysed under the same conditions as an authentic reference standard if a legally defensible identification is to be achieved.

Laboratories that have synthesised their own reference standards have typically done so in response to a lack of availability of reference standards for new psychoactive substances, the prohibitive cost of available standards, coupled with licensing arrangements and associated delays. These factors have meant that the identification of new psychoactive substances is complicated, costly and time-consuming.

A number of companies specialise in providing reference standards for psychoactive substances of abuse and also for new psychoactive substances. A selection of these companies are listed below.

5.1 Toronto Research Chemicals

Toronto Research Chemicals lists a range of new psychoactive substance reference standards in its online catalogue. It supplies reference standards to LGC Standards, and claims to be the only company offering this range of reference standards. Prices are stated in its online catalogue.

Toronto Research Chemicals Inc,
2 Brisbane Road, North York, Ontario, Canada M3J 2J8

Tel: (416)-665-9596
www.trc-canada.com

5.2 LGC Standards Reference Standards

Head office:
LGC Standards, Queens Road, Teddington,
Middlesex TW11 0LY, United Kingdom

Tel: +44 (0)20 8943 8480
Fax: +44 (0)20 8943 7554
Email: *uksales@lgcstandards.com*

Ireland Contact :

Patrick Henry, 4 Manor Lodge, Magherafelt,
County Derry BT45 6QL, Northern Ireland

Tel: +44 (0)28 7930 0078
Mobile: 07921 872595
Email: *Patrick.Henry@lgcstandards.com*

1. Cathinone HCl20mg: £134
2. (+/-)-Methcathinone HCl20mg: £163
3. N-Ethylcathinone HCl10mg: £133
4. 3-Fluoromethcathinone HCl10mg: £169
5. 4-Fluoromethcathinone (Flephedrone) 5mg: £180
6. Diethylpropion Hydrochloride: £146
7. Methedrone Hydrochloride: £172
8. 3,4-Methylenedioxymethcathinone HCl: £137
9. Ethylone 5mg: £172
10. Butylone HCl 20mg: £133
11. Methylenedioxypyrovalerone HCl 10mg: £172
12. (+/-)-4-Methylmethcathinone hydrochloride 10mg: £134
13. Mephedrone 25mg: £146
14. Bupropion Hydrochloride 10mg: £88
15. S(-)-Cathinone HCl (1.0mg/ml) (as free base) in Methanol 1ml: £31
16. R(-)-Cathinone HCl (1.0mg/ml) in Methanol 1ml: £31
17. Cathinone-d3 Hydrochloride 1mg: £172
18. Methcathinone 10mg: £146
19. S(-)-Methcathinone HCl (1.0mg/ml) 1ml: £27
20. R(+)- Methcathinone HCl (1.0mg/ml) 1ml: £27
21. Methcathinone-d3: £172
22. Mephedrone-d3 1mg: £159
23. Rac Diethylpropion-d10 Hydrochloride: £159
24. Bupropion HCl (1.0mg/ml) (as free base) in Methanol 1ml: £55
25. Methylenedioxymethcathinone-d3 Hydrochloride: £159

5.3 Institute for Reference Materials and Measurements (IRMM)

Reference standards can be ordered from the Reference Materials Unit at the Institute for Reference Materials and Measurements (IRMM), which is part of the European Commission Joint Research Centre. Orders must be requested from the IRRM by fax or by letter, and marked for the attention of the reference materials sales department. Postal address details as follows:

IRMM, European Commission Joint Research Centre,
Retieseweg 111, B-2440 Geel, Belgium

Tel: +32 (0)14 571 705
Fax: +32 (0)14 590 406

Reference standards may also be ordered from authorised distributors of IRRM. Details as follows:

LGC Standards GmbH, Mercatorstrasse 51,
D-46485 Wesel, Germany

Tel: + 49 281 9887 0
Fax: + 49 281 9887 299
Email: *de@lgcstandards.com*

Sigma-Aldrich Chemie GmbH, Industriestrasse 25,
CH-9471 Buchs, Switzerland

Tel: + 41 81 755 2828
Fax: + 41 81 755 2815
Email: *flukatec@sial.com*

RTC, PO Box 1346, 2931 Soldier Springs Road,
Laramie, WY 82070, USA

Tel: + 1 307 742 5452
Fax + 1 307 745 7936
Email: *orders@rt-corp.com*

ARMI, 700 Corporate Circle, Suite A,
Golden, CO 80401, USA

Tel: +1 303 216 2621
Fax: +1 303 216 2649
Email: *sales@armi.com*

Industrial Analytical, 4 Indianapolis Road, Kyalami Business Park,
Kyalami 1684, Republic of South Africa

Tel: +27 11 466 4321
Fax:+27 11 466 4611
Email: *info@industrialanalytical.co.za*

6 Review of practice in other countries

In this section, we analyse measures taken in other jurisdictions to restrict psychoactive substances.

Information exchange, risk assessment and control in the EU

In the EU, information exchange, risk assessment and control of new psychoactive substances is governed by EU Council Decision (2005/387/JHA). The purpose of this Council Decision is to rapidly share information about new and emerging psychoactive substances and to build on the Joint Action of 16 June 1997 concerning the information exchange, risk assessment and control of new synthetic drugs. Through the Reitox National Focal Point, each member state provides information on the manufacture, traffic and use of new psychoactive substances to Europol and the EMCDDA, which in turn share this information with all other member states. If Europol and the EMCDDA consider that the collection of further information is merited, this is collated in the form of a 'Joint Report' which includes, inter alia, information on chemical composition, the involvement of organised crime, health and social risks, and whether the substance is subject to control measures in any member state. The Joint Report is submitted to the Council of the European Union and the European Medicines Agency.

On receipt of the Joint Report, the Council may request risk assessment of new psychoactive substances "in order to permit the measures applicable in the Member States for control of narcotic and psychotropic substances to be applied also to new psychoactive substances" (Action 1). This risk assessment is prepared by the EMCDDA. It provides a physical and chemical description of the substance, and outlines the health and social risks of the new psychoactive substance, as well as information on the involvement of organised crime and options for control measures.

For example, the EMCDDA issued the Risk Assessment Report for 4-methylmethcathinone mephedrone in September 2010[42]. With regard to health risks, the report notes that no epidemiological data on prevalence has been published and that the most detailed information comes from studies of UK clubbers. Some users report effects that are better and longer lasting than those of cocaine. Reported adverse effects include 'sweating, headaches, tachycardia, palpitations, nausea, chest pain, bruxism (teeth grinding), agitation/ aggression and paranoia.' Two fatalities in which mephedrone appears to be the sole cause of death (one in Sweden and one in the United Kingdom) are reported. In addition:

> 'There are at least another 37 deaths in the United Kingdom and Ireland in which mephedrone has been detected in post-mortem blood and/or urine toxicology screening. In some of these cases it is likely that other drugs and/or other medical conditions or trauma may have contributed to or been responsible for death. The inquests into the deaths are pending for the majority of these cases, therefore it is not possible at this time to determine the contribution of mephedrone'[43] (p 7).

The report notes that mephedrone is controlled under drug control legislation in 11 member states (Belgium, Denmark, Germany, Estonia, Ireland, France, Italy, Lithuania, Romania, Sweden and the United Kingdom), and in Croatia and Norway. Most of these bans have come into force in the last ten months. In Ireland, mephedrone has been controlled under the Misuse of Drugs Act, by SI No199 of 2010 since 11 May 2010. Furthermore, two States (the Netherlands and Finland) "apply control measures to mephedrone under their medicines legislation. In the Netherlands, mephedrone is classified as a medicine and is therefore controlled under medicinal products legislation. In Finland, mephedrone has been classified as a medicine since September 2008 under the Medicines Act (395/87)" (p 12).

42 *http://www.emcdda.europa.eu/attachements.cfm/att_116485_EN_Risk%20Assessment%20Report%20on%20mephedrone.pdf*

43 Mephedrone has been implicated in four deaths in Ireland (Dr Des Corrigan, personal communication).

Legal measures against psychoactive substances in the EU

The primary source of information about legal measures taken across EU countries (and Norway) is the 'European Legal Database on Drugs' *http://eldd.emcdda.europa.eu*). This website contains details such as:

- Legal texts in their original formats
- Country reports and profiles[44]
- Legal reports on particular issues
- Brief topic overviews

Below we shall focus on one of the legal reports, *Legal responses to new psychoactive substances in Europe* (Hughes and Blidaru, 2009). This report outlines the range of control mechanisms in place throughout European countries. The information was obtained by sending questionnaires to the European Legal Database on Drugs (ELDD) Legal Correspondents network.

Generally, countries use one of three systems to restrict/ban psychoactive substances:

1. The individual listing system, whereby a chemical definition, based on UN Conventions, is detailed in legislation or Ministerial orders
2. The generic system, whereby groups of substances are defined e.g. precise compounds which are structurally derived from a specific psychoactive substance. The generic system is an attempt to 'future proof' legislation and "keep one step ahead of the illicit manufacturers" (Association of Chief Police Officers of England, Wales and Northern Ireland, 2010). The generic system is used in Ireland and the UK. The April 2010 banning of cathinone derivatives (such as mephedrone) in the UK is believed to be the world's first generic ban of a group of cathinones based on chemical structure (Morris, 2010).
3. The analogue system, which addresses more general aspects of similarity in chemical structure to a 'parent' compound (Hughes and Blidaru, 2009, p 6). This approach "prohibits a chemical if it is 'substantially similar in structure' to an already prohibited drug, and has a 'substantially similar chemical effect'" (Kau, 2008, cited in Hughes and Blidaru, 2009).

Hughes and Blidaru (2009) detail the legal mechanisms by which psychoactive substances are banned in each country. For Ireland, the legal basis for controlling substances is s.2 (2) of the Misuse of Drugs Act 1977, combined with governmental declaration orders. The Declaration Order is sent to Cabinet by the Minister for Health and Children, and, if approved, is signed by the Taoiseach. It must then be laid before both houses of the Oireachtas within 21 sitting days.

The particular arrangements in each country are detailed in Hughes and Blidaru (2009). It is worth noting that a number of countries allow for rapid banning of a substance. In the case of Denmark, an Executive Order on Euphoriant Substances can enter into force in two to three days. Germany, too, has an emergency provision whereby the Federal Ministry of Health may publish a regulation in the Federal Law Gazette without reference to the Council of Ministers or the Bundesrat. This process takes 'about a week', but expires within one year (during which time the 'standard' procedure for the banning of a substance should be followed). Spain has a particularly streamlined system: the Minister for Health and Consumer Affairs prepares an Order, which is published in the Spanish Official Journal (with no reference to Parliament) and the entire process

44 These country profiles provide general overviews of drugs legislation and policies introduced in recent years. The profiles do not contain updates on recent developments, such as the banning of certain head shop products (the most recent post on the news page, for example, is May 2008).

takes between five and 15 days. In contrast, the length of the procedure in the Czech Republic is 'usually about one year'.

On 19 August 2010, the Home Office in the UK announced[45] a system of temporary 12-month bans on new 'legal highs', in order to allow independent experts time to consider potential health risks. Permanent bans may follow thereafter, should this be advised by the Advisory Council on Misuse of Drugs. The Minister for Crime Prevention, James Brokenshire, stated:

> The temporary ban allows us to act straightaway to stop new substances gaining a foothold in the market and help us tackle unscrupulous drug dealers trying to get round the law by peddling dangerous chemicals to young people.

The penalty for supply will be a maximum of 14 years in prison and an unlimited fine. Subject to parliamentary approval, it is planned to introduce the system of temporary bans by the end of 2011.

Use of main drug control laws to ban substances

Ireland's approach of inserting the classification into the main drug control law is shared by 18 other countries.

National risk assessment procedure

The various EU member states have a spread of risk assessment procedures in place. Six member states have no national risk assessment process in place (due to reliance on international or European risk assessment). In seven countries, including Ireland, there is provision for ad hoc risk assessment, should it be deemed necessary. In seven countries, risk assessment is part of the administrative process of banning a product and in the final six countries it is directly referred to in the main drug control legislation.

There is also variation in who actually carries out the risk assessment. In 16 EU member states, (including Ireland), it is carried out by a group of experts within the public administration. In a further six countries, consultation takes place with independent experts, as the need arises. In three countries, risk assessment is carried out by independent scientific bodies.

Recent ban of Naphyrone in the UK

The UK Advisory Council on Misuse of Drugs (AMCD) has noted the shift in attention, usage, supply and advertising from mephedrone to naphyrone ['the new mephedrone'] after the April 2010 ban. Following advice from the ACMD (2010b), naphyrone ['NRG 1'] (which has a close structural resemblance to the cathinones) was classed as a Class B drug from 23 July 2010. The penalty for possession of this drug is a maximum of five years in prison. For supplying this drug, the penalty is 14 years in prison (and an unlimited fine).

45 *http://www.homeoffice.gov.uk/media-centre/press-releases/fight-legal-highs*

In the UK context,, Measham *et al.* (2010) are dubious that the banning of particular compounds will have any lasting effect on the supply of products:

> "One thing is certain: no matter how wide the net is cast in terms of framing legislation to control mephedrone use, the 'research chemists' and cyber-entrepreneurs are likely to remain one step ahead … Until people no longer want to take drugs to experience altered states of intoxication and until the possibilities for chemically 'tweaking' molecules are exhausted, the cat and mouse antics witnessed with 'Meow' will continue" (p 20).

Only time will tell whether the Irish 'blanket ban' brings a halt to the 'cat and mouse antics' on the streets at least, if not in cyberspace.

Ireland's Criminal Justice (Psychoactive Substances) Act, 2010

Ireland's Criminal Justice (Psyhoactive Substances) Act, 2010 came into effect on 23August 2010. Elsewhere in the EU, there is no comparable legislation. Given its sweeping powers and the proscription on importing, exporting and selling psychoactive substances, this piece of legislation may become a model for other European countries in tackling the selling of head shop products. But the challenge of tackling the sale of products online will remain.

Banning of drug paraphernalia

In contrast with Europe, where the focus has been on banning harmful compounds, in Florida, the sale of certain drug paraphernalia has been illegal since 1 July 2010[46] ('Florida statutes 569.0073 Special provisions; smoking pipes and smoking 14 devices'). Water pipes, air pipes and hookahs are now classified as drug paraphernalia and it is an offence for a store to sell paraphernalia if 75% of a tobacco store's annual profits are not derived from the sale of tobacco. No more than 25% of profits may be derived from drug paraphernalia. Obviously, the introduction of any such legislation in Ireland would generate debate as to what constitutes a 'bong' and the availability of alternative devices for smoking. However, the targeting of devices that have no other function other than to consume illicit drugs such as cannabis would further challenge the 'normalisation' of drug use.

Targeting of website operators

In Section 2 of this report we outlined how the US Drug Enforcement Agency (DEA) identified and arrested website operators who were selling banned substances online. If the Criminal Justice (Psychoactive Substances) Act, 2010 results in the closure of head shops, Irish Government initiatives to control 'legal highs' will have to move to 'bring the fight online'. Options will include the targeting of website operators, as per the DEA Operation *Web Tryp*.

Related initiatives would involve working with Internet service providers to ensure that Irish website users do not have access to websites selling banned substances. Dr Chris Luke, Emergency Department Consultant at the Mercy University Hospital in Cork , is of the view that such sites should be monitored, controlled and shut down. In terms of further addressing the issue, efforts could be made to examine existing models of online monitoring which may curtail such trade, including, for example, the model of co-operation that is in place between the Irish Medicines Board and the Customs authorities to monitor the sale of counterfeit medicines.

46 *http://www.miamiherald.com/2010/08/08/1764650/bong-ban-aims-to-smoke-out-head.html*

7 Conclusions and recommendations

We have examined the use of psychoactive substances in Ireland from a variety of perspectives. Novel chemical analyses have been conducted; we have described the emerging scientific literature; we have conducted an online survey of users as well as a number of interviews with both 'recreational' and 'problem' users. We have also considered risk factors and harm-reduction measures, and we have examined approaches to restricting psychoactive substances in other jurisdictions.

1. A challenge may exist in terms of the monitoring of online outlets for the sale and supply of new psychoactive substances. In terms of further addressing this issue, efforts could be made to examine existing models of online monitoring which may curtail such trade including, for example, the model of co-operation in place between the Irish Medicines Board and the Customs authorities to monitor the sale of counterfeit medicines.

2. Given Ireland's geographical proximity to the UK, and the close cultural links that exist between the two countries, Ireland should collaborate more closely with initiatives in the UK and other EU neighbours aimed at restricting access to new psychoactive substances.

3. The 'Hospital Emergency Department' component of this study has not yet been completed. Preliminary contacts, however, indicate that there is no readily accessible database of 'presenting issues' to hospital emergency departments. This makes it impossible to quantify the harm being caused by existing and newly emerging synthetic chemicals. It is recommended that such data that is collected at local hospital level is centralised at some appropriate agency, such as the Health Research Board (HRB), the Economic and Social Research Institute (ESRI) (which details hospital admissions each year) or the National Advisory Committee on Drugs (NACD). This will give a clearer, empirical picture of the harm that is being caused by head shop products, and it will replace the current system of relying on anecdotal reports.

4. A system of routine reporting of new psychoactive substances intoxication to the National Poisons Information Centre is recommended in order to facilitate the building of a knowledge base.

5. The survey results show that many users report strong negative reactions to consumption of 'legal highs' and also indicate the existence of a vibrant online community of (mostly) young people who are willing to experiment with and discuss new psychoactive substances. In contrast, the public health message as to the risks/dangers of 'legal highs' is rather muted, particularly in the online fora frequented by young people. We recommend a much more dynamic stating of the risks of 'legal highs' on the various online media outlets used by young people such as Facebook, in addition to the placement of advertisements there and active engagement with threads in chat rooms etc.

6. Given the level of polydrug use reported by survey respondents, it is recommended that interventions be designed to specifically target this pattern of substance abuse.

7. Initial indications are that drug consumption choices and patterns of use are shifting in response to recent legislative changes. It is recommended that the impact of these changes be monitored and assessed, so that any new risks that may emerge can be identified, and appropriate responses developed.

8. Ireland does not have a specific research laboratory dedicated to the monitoring of developments in new psychoactive substances. There is potential for the establishment of a dedicated laboratory that can assume responsibility for rigorous testing of these new and emerging psychoactive substances – a laboratory that would have the time, manpower and resources to test for characteristics such as purity and concentration in any new product that appears on the market, and to carry out such tests on a regular basis.

9. The availability of reference standards for new psychoactive substances is limited. Companies that provide them do so at very high prices, possibly reflecting the lack of competition in this area. In addition, the time frame required to acquire reference standards can be prohibitive. In some cases, a licence must be obtained for the particular substance before a reference standard can be ordered, and the turnaround for delivery may be several weeks. There is scope for the establishment in Ireland of a reference standards body/company that could respond more rapidly according as new substances appear on the market. Such a laboratory could provide a dedicated service not just to Ireland, but to other EU countries, thus providing a continent-wide service/resource to address the issue of newly emerging psychoactive substances.

10. The continuation of a pragmatic public health approach to new psychoactive substances is recommended. Despite historical efforts to control a variety of substances, they have consistently been available through illegal suppliers. In keeping with this public health approach, a number of broad harm-reduction measures are suggested and are outlined in Section 4.2 of this report.

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Appendix A: New psychoactive substances and their psychoactive constituents

Table A1 Review and comparison of analysis performed on powder products (up to August 2010)

Powders	TICTAC	FSL	Kavanagh and colleagues
'Amplified'	–	–	Dimethocaine (also desethyl dimethocaine)
'Charge +'	–	Flephedrone	Flephedrone, Lignocaine, Caffeine
'Dust'	3-FMC and Caffeine	–	–
'Energy-1'	Butylone and MDPV	–	–
'Energy-1 Powder'	4-FMC	–	–
'Flake'	–	Butylone	Butylone (pre-11/05/10)/ Dimethocaine (post-11/05/10)
'Hurricane Charlie'	MDPV and Lignocaine	MDPV/Butylone	MDPV
'K powder'	Mephedrone and Lignocaine	–	–
'Lunar Wave'	–	Mephedrone/ Lignocaine	–
'Mind Melt'	Butylone and Lignocaine	–	Dimethocaine/ Naphyrone
'Ocean Burst'	–	MDPV/Lignocaine	–
'Ocean Snow'	–	Butylone	–
'Oceanic Deeper'	–	–	Flephedrone, Lignocaine, Caffeine
'Raz'	Butylone, Mephedrone,Lidocaine	–	Caffeine, Lignocaine and Levodopa
'Recharge'	–	Mephedrone	–
'Sextacy'	Mephedrone and Lignocaine	MDPV/Mephedrone/ Butylone/Lignocaine	MDPV, Lignocaine
'Snow Berry'	Caffeine	–	Caffeine
'The Business'	–	–	Mephedrone
'The Ministry'	–	–	Butylone
'Vanilla Sky'	–	–	MDPBP
'White Ice'	–	–	Flephedrone, Lignocaine, Caffeine

3-FMC: 3-Fluoromethcathinone; MDPV: Methylenedioxypyrovalerone; 4-FMC: 4-Fluoromethcathinone; MDPBP: 3',4'-Methylenedioxy-α-pyrrolidinobutiophenone.

(–): Denotes results were not available.

Table A2 Review and comparison of analysis performed on capsule and tablet products (up to August 2010)

Capsules/Tablets	TICTAC	FSL	Kavanagh and colleagues
'Asylum'	–	MBZP/TFMPP	–
'Benzo Berries'	pFPP	–	–
'Berry Mashed'	–	Fluorophenylpiperazine	–
'Bliss 04'	–	Caffeine	–
'Bliss Bomb'	–	–	DMAA, Caffeine
'Bliss Extra'	–	Caffeine	–
'Blow'	–	Mephedrone/ Benzocaine/Caffeine	–
'Bolts'	BZP,DBZP	–	–
'Charged'	–	Caffeine	–
'Charleeze'	–	MBZP/TFMPP/Caffeine	–
'Charleeze Extra Strong'	–	BZP/MBZP/TFMPP/ Caffeine	–
'Cherries'	TFMPP, Caffeine	MBZP/TFMPP/Caffeine/ Fluorophenylpiperazine	–
'Craic'	–	–	Methylone
'Crank/Crank'd/ Cranked'	–	–	DMAA, 2-PEA, Caffeine
'Diablo XXX'	BZP/TFMPP/DBZP	–	Mephedrone
'Diablos XXX Extreme'	–	Mephedrone	–
'Disco Biskit'		BZP/TFMPP,DBZP	–
'Doves Original'	Mephedrone/BZP and TFMPP	–	–
'Doves Red'	MDPV	–	MDPV
'Doves Ultra'	Butylone	–	Butylone
'Dr Feelgood'	–	–	DMAA, 2-PEA
'E Blast'	BZP/TFMPP/DBZP	BZP/TFMPP,DBZP	–
'E Bomb'	–	Caffeine/TFMPP/ Fluorophenylpiperazine	m-Trifluoromethylphenylpiperazine, Caffeine
'e-Blast'	BZP/TFMPP/DBZP	–	–
'Ecstacy X4'	–	MBZP/TFMPP	–

Table A2 Review and comparison of analysis performed on capsule and tablet products (up to August 2010) (continued)

Capsules/Tablets	TICTAC	FSL	Kavanagh and colleagues
'EFX'	BZP/TFMPP	BZP/TFMPP/DBZP	–
'Elevate'	Caffeine/Ephedrine or Caffeine	–	–
'Energy'	Caffeine	Caffeine	DMAA, Caffeine
'Entropy'	Glaucine, Tetrahydropalmatine	–	Glaucine
'EX:1'	Sida Cordifolia, Ephedra extract (Ma-Huang)	–	–
'Exotic Super Extra Strength'	MBZP/BZP/DBZP	–	–
'Exotix Super Strong'	BZP/ TFMPP	–	–
'Exotix Ultra'	Butylone/ MDPV	Butylone	–
'EZ-E Party Pills'	–	Mephedrone	–
'Fast Lane'	BZP	–	–
'Fast Layn'	–	–	DMAA, Caffeine
'Fast Trax'	–	MDPV/Mephedrone/ Methylone/Caffeine	–
'Flying Angel'	BZP/TFMPP	BZP/TFMPP	–
'Foo King EZ'	–	Butylone, Mannitol	–
'Frenzy'	–	BZP/DBZP/Caffeine	–
'Gems bling bling'	–	Ephedrine	–
'Giggle'	pFPP	Caffeine, Piperine	Glaucine, Caffeine, Synephrine, DMAA
'Gold Crowns'	–	–	DMAA, 2-PEA, Caffeine
'Golden Bullets'	–	Glaucine/Caffeine	–
'Green Apples'	–	Caffeine	–
'Groov-e'	Caffeine	–	–
'Groove'	Glaucine	–	–
'Groove E'	Caffeine	–	–
'Happy Popper Beans'	–	TFMPP/Caffeine	–

Table A2 Review and comparison of analysis performed on capsule and tablet products (up to August 2010) (continued)

Capsules/Tablets	TICTAC	FSL	Kavanagh and colleagues
'Happy-Caps'	–	–	–
'Hard Core'	–	Caffeine	–
'Head Rush'	Butylone or CPP/ MBZP/TFMPP or Ephedrine	Ephedrine	–
'Hibena'	BZP/TFMPP/Caffeine	–	–
'Hummer'	Caffeine	BZP/Caffeine	–
'Hyper X'	MDPV or Ephedrine	–	–
'Hypnotic'	–	Caffeine/Glaucine	–
'Instantly Smashed'	–	MBZP/TFMPP/Caffeine	–
'Jax'	BZP/TFMPP	–	–
'Joker'	–	p-fluorophenylpiperazine	–
'Jokers'	–	Methylone/Butylone/ Caffeine	–
'Lime Fantasia'	–	BZP, DBZP/MEOPP, MCPP	–
'Lime Fantasy'	–	Methylone	–
'Loved Up'	Caffeine/pFPP	Caffeine/p-fluorophenylpiperazine	p-fluorophenylpiperazine, Caffeine
'Majik'	BZP/TFMPP or BZP/ TFMPP/DBZP	BZP/TFMPP/Tryptamine	–
'Mint Mania'	–	–	Dimethocaine (Methylone pre Ban)
'Mitseez'	Butylone, Caffeine	Butylone	Butylone, Caffeine
'Molotov'	–	–	DMAA, 2-PEA, Caffeine, Synephrine, Hordenine
'Move'	Caffeine	–	–
'Nemesis'	–	–	DMAA, 2-PEA, Caffeine
'Neuro Trance'	BZP/TFMPP/DBZP	BZP/DBZP	–
'Nirvana'	–	Caffeine	–
'Nirvana Gold'	–	BZP/TFMPP	–
'Nirvana Platinum'	–	BZP/TFMPP	–
'NRG'	Caffeine or Ephedrine	–	–
'NXT Phase' (various colours)	–	Caffeine	–

Table A2 Review and comparison of analysis performed on capsule and tablet products (up to August 2010) (continued)

Capsules/Tablets	TICTAC	FSL	Kavanagh and colleagues
'Orange x-tra'	BZP/TFMPP/Kola	BZP/TFMPP	–
'Paddy's Party Pills'	–	BZP/TFMPP/DBZP	–
'Paddy's Polski Party Pills'	–	BZP	–
'Party Pillz Up All Night'	Caffeine	–	–
'Pepe'	–	Caffeine	–
'Pink Champagnes'	–	Caffeine	2-Aminoindane, Caffeine
'Pinkys'	–	–	DMAA, Caffeine
'Pure 04'	–	Caffeine	–
'Pure Go-E'	–	–	DMAA, 2-PEA, Hordenine, Synephrine, Caffeine
'Red Rockets'	BZP	BZP	
'Redd Hearts'	–	Caffeine	2-PEA, Hordenine, Caffeine
'Rocket Fuel'	Butylone or Ephedrine	–	–
'Sex Intense'	NCD or Ephedrine	–	–
'Smileys'	BZP/TFMPP/Caffeine	–	–
'Space E'	Caffeine or Ephedrine/Caffeine	–	–
'Space Trips'	MDPV OR MBZP/ TFMPP	–	–
'Spaced'	–	Glaucine	Glaucine, Caffeine
'Speed Freak'	Ephedrine	–	–
'Speed Rush'	BZP/TFMPP/DBZP	BZP/DBZP	–
'Stacker 2 ephedra free'	Ephedra Extract (Ma-Huang), Kola, Willow Bark	–	–
'Stargate'	–	1,2-methoxyphenyl piperazine	–
'Summer Daze'	Butylone	Butylone	Butylone
'Super E'	TFMPP and Caffeine or TFMPP,pFPP, Caffeine	Fluorophenylpiperazine/ TFMPP/Caffeine	–
'Super e'	–	MBZP/TFMPP/Caffeine/ Piperine	–

Table A2 Review and comparison of analysis performed on capsule and tablet products (up to August 2010) (continued)

Capsules/Tablets	TICTAC	FSL	Kavanagh and colleagues
'Surge'	–	MBZP/TFMPP	–
'Trance'	–	–	DMAA, Caffeine
'Total Highs X'	–	MBZP/TFMPP	–
'Trip E'	Caffeine	–	–
'Turbo III'	–	Caffeine	–
'Twisted'	BZP,TFMPP.pMeOPP	BZP, MEOPP, FPP, TFMPP	–
'XXX'	BZP,TFMPP	–	–
'Yellow Veggies'	–	BZP, MEOPP, CPP, TFMPP	–

MBZP: 1-Benzyl-4-methylpiperazine; TFMPP: 1-(3-Trifluoromethylphenyl) piperazine; pFPP: p-fluorophenylpiperazine; DMAA: Dimethylamylamine; BZP: 1-Benzylpiperazine; DBZP: 1,4-Dibenzylpiperazine; 2-PEA: 2-Phenylethylamine; MDPV: Methylenedioxypyrovalerone; CPP: Chlorophenylpiperazine; MeOPP: Methoxyphenylpiperazinel; mCPP: 1-(3-Chlorophenyl)piperazine NCD: No Controlled Drugs;

(–): Denotes results were not available.

Table A3 Review and comparison of analysis performed on smoking blend products (up to August 2010)

Smoking Blends	TICTAC	FSL	Kavanagh and colleagues
'Atomic Bomb'	–	–	3-[(adamantan-1-yl)carbonyl]-1-pentylindole
'Bonzai'	–	JWH-018	–
'Bonzai Citrus'	–	JWH-018	–
'Diamond Strawberry'	JWH-018, -073, -398, -250	–	–
'Ex- Ses-Platinum Plus'	JWH-018, CP47497	–	–
'Fat Mary'	–	–	3-(4-Methoxybenzoyl)-1-pentylindole
'Firefly'	–	JWH-018	–
'Firefly Gold'	–	–	3-(4-Methoxybenzoyl)-1-pentylindole
'Gold Strawberry'	JWH-018, -073, -398, -250	–	–
'Grass'	–	–	AM-694

Table A3 Review and comparison of analysis performed on smoking blend products (up to August 2010) (continued)

Smoking Blends	TICTAC	FSL	Kavanagh and colleagues
'Ice Bud Super Cold'	JWH-018, -073, -250, CP47497	–	–
'KI Fire Blend'	JWH-018, -073, -398, -250	–	–
'King BBB'	–	JWH-018	–
'Kratom'	Mitragynine	–	–
'Lunar Diamond Blueberry'	JWH-018, -073, -398, -250	–	–
'Pulse Gold'	JWH-018	JWH-018	–
'Shamrock'	–	–	AM-694
'Smoke Ultra'	JWH-018, -073, -398, -250	–	–
'Smoke XXX'	–	JWH-018	AM-694
'Smoke XXXX'	–	Glaucine	–
'Spice Diamond'	JWH-018, CP47497	–	–
'Spice Gold'	JWH-018, CP47497	–	–
'Spicey XXX Ultra Strong'	JWH-018, CP47497	–	–
'Tai High'	–	–	1-[(N-methyl-2-piperidinyl)methyl]-3-(1-naphthoyl)indole
'The Green Harp'	–	–	AM-694
'Tribal Warrior'	JWH-073, -250, CP47497	–	–
'Virgin seeds'	JWH-073,JWH-250,CP47497	–	–
'Xscape'	–	–	Mitragynine

JWH-018: 1-pentyl-3-(1-naphthoyl)indole; JWH-073: 1-butyl-3-(1-naphthoyl) indole; JWH-398: 1-pentyl-3-(4-chloro-1-naphthoyl)indole; JWH-250: 2-(2-methoxyphenyl)-1-(1-pentylindol-3-yl)ethanone; CP47497: 2-[(1R,3S)-3-hydroxycyclohexyl]-5-(2-methyloctan-2-yl)phenol; AM-694: 1-(5-fluoropentyl)-3-(2-iodobenzoyl)indole;

(–): Denotes results were not available.

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